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LABYRINTH REACTIONS AND THEIR CLINICAL IMPORTANCE.*

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Flourens, in 1825, was about the first to associate the ear with nystagmus and equilibrium. His experimentations upon pigeons and rabbits established the fact that the section of any one of the semicircular canals gives rise to uncontrollable movements of the head and eyes in the plane of the canal experimented upon. In 1861, Menière, in describing his classical case, clearly recognized that vertigo had some relation to diseased ears. It was Goltz, in 1870, who first advanced the theory that the semicircular canals were the organs of equilibrium and that the movement of the endolymph caused a stimulation of the hair fibres. This was concurred in by Ewald, of Strasburg, in 1892, by his experiments. He opened a canal and by a suitable plug occluded completely the membranous portion at a position near the ampulla. A second opening was made through the bony walls of the canal and a small piston introduced. This piston was in communication with a bulb, so that by compression or aspiration the endolymph could be moved at will, either toward or away from the ampulla. These experiments are the basis of our present knowledge of the phenomena of vestibular irritation.

In 1894, Shaefer found no turning dizziness in animals devoid of semicircular canals. It was Hoegye, a Hungarian, who made the first systematized contribution in the study of the labyrinth. His law became famous: "When the centre

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of one side is stimulated from the vestibular apparatus, the adductor ocular muscles on the same side and the abductor muscles on the opposite side contract, resulting in a slow conjugate movement of the eyes in a direction away from the stimulated centre. Thus, stimulation of the right centre brings about a slow movement to the left, and vice versa." While this law is important, and, in many otologic schools serves as a basis for nystagmic understanding, it is far from being complete.

To the late Robert Barany,[1] formerly of Vienna, later of Upsala, Sweden, we owe our clinical knowledge in his sensational work. This practical application was further advanced by the School of Vienna, including such men as Neumann, Ruttin and Alexander.

Any irritation of the labyrinth will produce the well recognized triad: namely, spontaneous nystagmus, spontaneous vertigo, spontaneous past pointing and falling. When the nystagmus is brought about experimentally, it is "induced." When by a pathological lesion it is spontaneous.

NYSTAGMUS.

Vestibular		Non-Vestibular
		Ocular
Central	Peripheral	(a) Physiological (b) Paresis of external or internal rectus (c) Congenital (d) Fixation (e) Coal miners' (f) Spasmus nutans (g) Latent nystagmus

Vestibular nystagmus is a rhythmical oscillation of the eyes with a quick movement in one direction and a slow movement in the opposite direction (Alexander and Braun,[3] Bondy,[4] Fremel,[5] Gradenigo,[6] Torrigiana,[7] Wilson and Pike[8]). When the eyes are turned in the direction of the quick component, the rapidity and the length of the excursions are usually increased. The direction of the nystagmus is named after the quick component. This is a misnomer. The slow component is vestibular, while the quick retort is cerebral. Nystagmus is involuntary and thereby not under the will's control. Labyrinth nystagmus has three different degrees: Nystagmus 1°

is when nystagmus to the right disappears when the patient looks straight ahead or to the left; nystagmus of 2° is when the nystagmus to the right is still present when the patient looks forward, but disappears when he looks to the left; nystagmus of 3° is when the nystagmus is present, regardless of what direction the patient looks. The amplitude of the nystagmus is spoken of as fine, middle fine and coarse. The form is either horizontal, rotary or vertical, or any combination of these. The nystagmus, hereafter, is the turning nystagmus with which we are concerned and not the nystagmus elicited during the rotation (G. W. MacKenzie[9]).

When a nystagmus does not follow above rules, it is not of labyrinthine origin. Vestibular nystagmus is subdivided into central and peripheral. Before going into the discussion and differentiation of these two important subdivisions, it is now in order to have a basic understanding of how nystagmus is brought about.

In order to have a thorough understanding of the mechanism of vestibular nystagmus, it is most essential to understand the laws of Flouren and Ewald, which were brought about experimentally.

Flouren's Law: Each canal perceives the turning movement in its own plane and gives nystagmus in its own plane. The horizontal canal gives a horizontal nystagmus. The frontal canals, with head forward or backward, give a rotary nystagmus. When the head is bent on either shoulder, the vertical canals are at right angle to long axis of the body and this gives a vertical nystagmus, either upwards or downwards. These will be given further consideration.

Ewald's Laws: 1. The movement from the smooth end of the semicircular canal towards the ampulla is the more effective movement. The movement from the ampulla towards the smooth end is the lesser effective movement. This law is applicable only to the horizontal canals. *2.* Movement from the ampullated end to the smooth end is the more effective movement and the movement from the smooth end toward the ampullated end less effective. This law is applicable to both vertical canals and just opposite to the first law. *3.* The more effective movement gives nystagmus to the same side and the lesser effective movement gives nystagmus to the opposite side. This law is applicable to all three canals.

The practical application of these fundamental laws is the very foundation of the vestibular reactions. The anatomical relationship of these three canals to the long axis of the body is most essential to understand. The endolymphatic movement is either toward or away from the ampullated ends. Fig. 1 illustrates this point clearly.

A cross-section of the horizontal canals shows that the ampullated ends are toward the long axis of the body and the nonampullated ends away or posterior to the long axis. Fig. 2 shows this relationship.

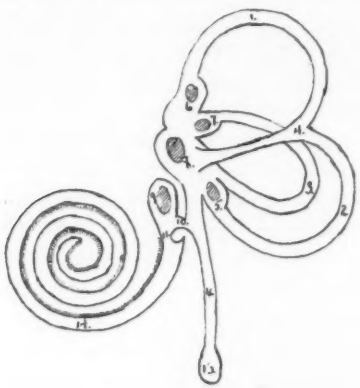


FIGURE 1. MEMBRANOUS LABYRINTH. (AFTER SCHAEFER)
1) ANTERIOR VERTICAL SEMICIRCULAR CANAL. 2) POSTERIOR VERTICAL CANAL. 3) HORIZONTAL SEMICIRCULAR CANAL. 4). CRUS COMMUNIS. 5) CRISTA ACUSTICA OF THE POSTERIOR VERTICAL CANAL. 6). CRISTA ACUSTICA OF THE ANTERIOR VERTICAL CANAL. 7). CRISTA ACUSTICA OF THE HORIZONTAL CANAL. 8). UTRICLE (MACULA) 9). SACCULE (MACULA). 10). UTRICLE SACCULE CANAL. 11). CANALIS REUNIENS. 12). AQUAEDUCTUS VESTIBULI. 13) SACCUS ENDOLYMPHATICUS (BLIND POUCH) 14). COCHLEAR CANAL.

We are all familiar with the technique of the rotation test (G. W. MacKenzie,[10] Brunner[11]). Turn 10 times to the right in 20 seconds. The nystagmus is horizontal because Flouren's law says that each canal gives a nystagmus in its own plane (horizontal). The nystagmus is to the left. Ewald's Laws 1 and 3 explain this readily: Law 1 says that the movement from the smooth end towards the ampulla is the more effective movement. Law 3, the more effective movement, gives nystagmus to the same side, ergo to the left. However, nystagmus comes from both canals. The ratio of the nystagmus from the more effective movement to the lesser effective movement is two to one.

In other words, a normal duration of nystagmus after turning is 24 seconds. The nystagmus to the left (above) is composed of two parts. One part, coming from the right horizontal canal and having the lesser effective movement, gives only one-third of its normal duration, or eight seconds; whereas the left horizontal canal gives two-thirds of its normal duration, or 16 seconds, because of the more effective movement. This explanation is the same in turning the patient to the left, resulting in a nystagmus to the right.

Fig. 3 shows a cross-section of the anterior superior vertical canals in its relation with the long axis of the body, with the head forward 120°. The ampullated ends are away from the long axis and the nonampullated ends are toward the long axis. This position brings the canals in a horizontal plane.

Turn patient to the right 10 times and apply the laws. The nystagmus is rotary (Flouren's Law) and to the left (Ewald's Laws 2 and 3).

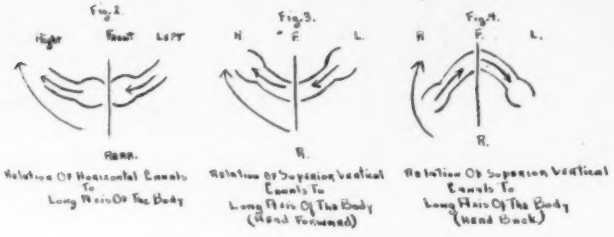
Place the head back 60° and the anterior superior vertical canals are in a horizontal plane. Fig. 4 will illustrate this point. The ampullated ends are away from the long axis of the body and the nonampullated ends are near and up towards the long axis of the body.

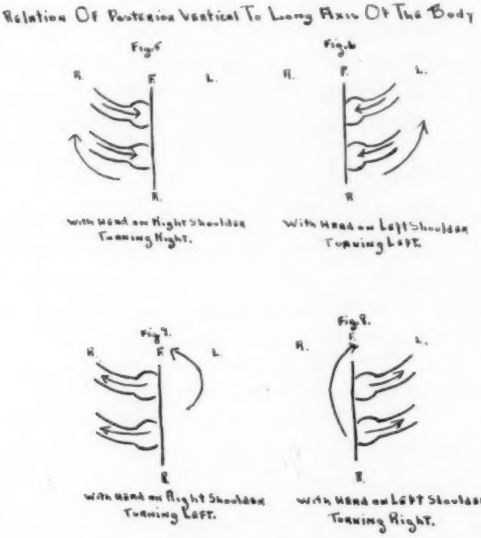
Turn right 10 times and the nystagmus is rotary (Flouren's Law) and to the right side (Ewald's Laws 2 and 3).

The posterior vertical canals lie in a sagittal plane and in order to bring them into a horizontal plane, bend the head to either shoulder. These canals are seldom examined. When the head is bent on either shoulder, both posterior vertical canals are equally distant from the long axis of the body in a horizontal plane, both upon the same side and thereby the endolymphatic movement is in the same direction.

Therefore, four possibilities arise: *1.* Fig. 5 shows the position of the posterior vertical canals when the head is bent on the right shoulder; ampullated ends near the long axis of body and nonampullated ends away. Turn right — the endolymphatic movement is from the nonampullated end to the ampullated end (Ewald's Laws 2 and 3) and gives a nystagmus to the opposite side, but since the sagittal canals can produce a nystagmus only in a sagittal plane — that is, up or

down — there then occurs a vertical nystagmus and, corresponding to the more effective movement, the nystagmus is directed downward. *2.* Fig. 6 shows the head on the left shoulder and turning to the left. Same explanation: Vertical nystagmus downward. *3.* Fig. 7 shows the head on right





shoulder, turned left, vertical nystagmus (Flouren's Law), to the same side and upward (Ewald's Laws 2 and 3). The movement on the right side from the ampullated to the non-ampullated end is the more effective movement. *4.* Fig. 8 shows head on left shoulder and turning to right. Vertical

nystagmus is on the same side and upwards (same explanation as Fig. 3).

AFTER ROTATIONAL NYSTAGMUS.

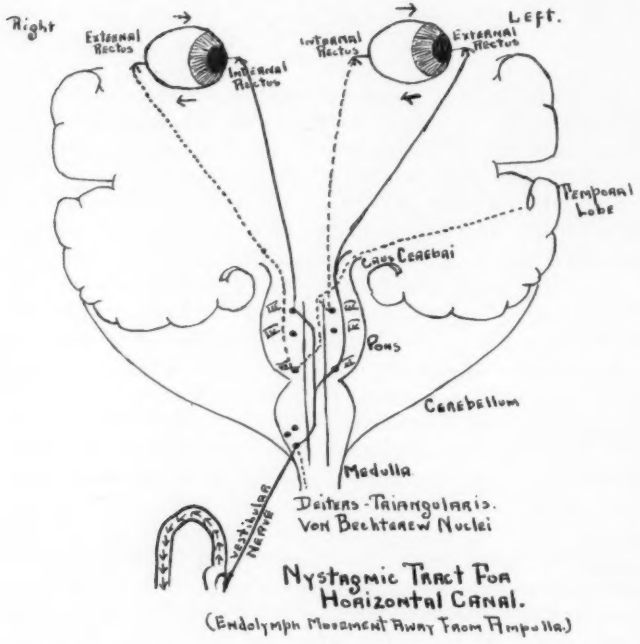
Direction of Turning	Position of Head	Direction—Kind—Duration of nystagmus
1. Right	Head erect, 30° forwards	→ 15-25 seconds
2. Left	Head erect, 30° forwards	← 15-25 seconds
3. Right	Head forwards 120°	↗ 8-12 seconds
4. Left	Head forwards 120°	↖ 8-12 seconds
5. Right	Head backwards 60°	↗ 8-12 seconds
6. Left	Head backwards 60°	↖ 8-12 seconds
7. Right	Head on right shoulder	↓ 6- 8 seconds
8. Left	Head on left shoulder	↓ 6- 8 seconds
9. Right	Head on left shoulder	↑ 4- 6 seconds
10. Left	Head on right shoulder	↑ 4- 6 seconds

Anatomically, nystagmus is readily understood when the vestibular nerve is traced centrally. On reaching the medulla oblongata, most of the fibres of the vestibular nerve end in the vestibular nuclei (Deiter's-triangularis and von Bechterew's), in the floor of the IVth ventricle, while some ascend through the inferior cerebellar peduncle into the vestibulocerebellar nuclei (globosus, emboliformis and fastigii); however, at this particular point, we will limit ourselves to the fibres going to the vestibular nuclei. From here, certain fibres, constituting the vestibulospinal fasciculus, pass downward to end around the motor cells in the anterior horn of the spinal medulla. This fact explains particularly the motor disturbances and alterations of muscle tonus associated with lesions of the vestibular apparatus. Most fibres enter Deiter's nucleus and from here enter the posterior longitudinal bundle, where important connections are made with other cerebral nerves: With the vagus nucleus, by which the vomiting, nausea and circulatory disturbances (pallor, clammy face) may accompany the vestibular irritation; the fibres coming from the horizontal canals (see Figs. 9 and 10) are seen going to the nuclei of the IIIrd and VIth nerves by way of the posterior longitudinal bundle, which control the movement of these ocular muscles, giving a horizontal movement. When the endolymphatic movement is away from the ampulla, as in Fig. 9, the slow component is to the opposite side, but when the endolymphatic movement is towards the ampullated end, as in Fig. 10, the slow component is to the same side. The fibres from the vertical canals (see Figs. 11 and 12), instead of going to Deiter's nucleus, go upward in the brain stem and

in the upper half of the pons, divide into two tracts: The nystagmic producing tract passes into the posterior longitudinal bundle and goes to the eye muscle nuclei of the IIIrd and IVth nerves, giving a rotary movement.

Fig. 11 shows the endolymphatic movement away from the ampullated ends; therefore, the slow or vestibular component is toward the opposite side, whereas Fig. 12 shows the endo-

Figure 9.

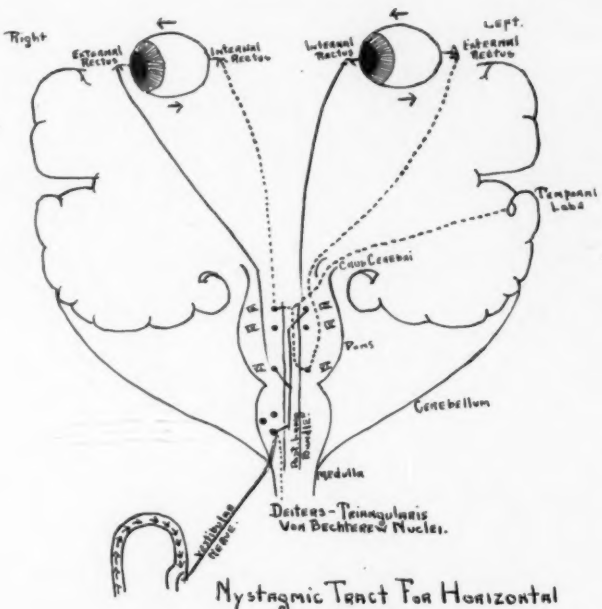


lymphatic movement towards the ampulla, with the slow or vestibular component towards the same side.

The vestibulo-ocular tract produces a slow conjugate movement of the eyes. The quick component is cerebral (see Figs. 9, 10, 11 and 12), sends impulses to the opposite eye muscle nuclei and thereby causing a quick return. This phenomenon constitutes nystagmus.

The cerebral centre for the quick component of nystagmus is not definitely known. This tract travels down through the internal capsule and, through the crus cerebri, enters the posterior longitudinal bundle at the upper part of the pons. The fibres are then distributed via the posterior longitudinal bundle to the various eye muscle nuclei. The right cerebral

Figure 10.



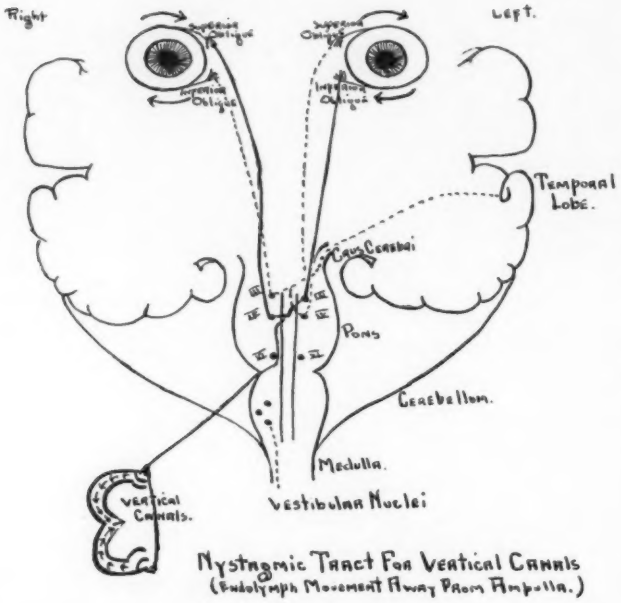
Nystagmic Tract For Horizontal Canal.
(Endolymph Movement Toward Ampulla.)

centre controls the quick component of both eyes to the left, and, conversely, the left cerebral centre controls the quick component of both eyes to the right (Jones[12]).

The slow component is phylogenetically and ontogenetically more primitive than the quick component and thereby more resistant. This explains in narcosis why there is a suspension of the cerebral component and not the slow vestibular component. Much experimental work has been done to deter-

mine the centre for the quick cerebral component. It still is a moot question. Wilson and Pike[8] say that the quick component of nystagmus is dependent upon the integrity of a cerebral reflex arc. Bauer and Leidler in their experimental researches find that the quick component is not dependent upon the cerebral cortex and that extirpation of the cerebrum,

Figure 11.



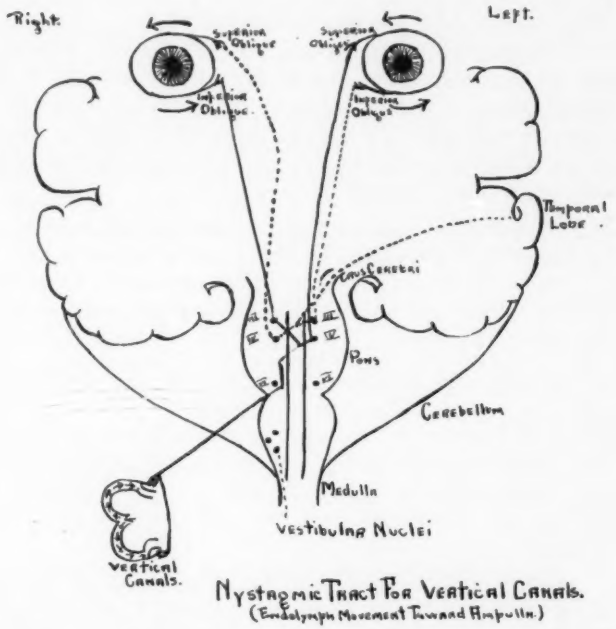
thalamus and even extensive destruction of the midbrain does not disturb the vestibular nystagmus. A. C. Ivy[13] contends that the quick component does not depend upon the integrity of the cerebral reflex arc but is dependent upon some centre below the thalamus over which the cerebrum exercises its well recognized inhibiting influences.

It was thought for a while that the nystagmus centre was in the cerebellum, but this has been proven to be false. Wilson and Pike[8] observed typical labyrinth nystagmus after complete removal of cerebellum. The slow component or quick return

have no necessary pathway nor any indispensable centre in the cerebellum.

The reflex arc for the quick component has its afferent fibres pass from the eye muscles back to the ocular motor nuclei and then in all probability through the thalamus, where they are relayed, and then on up to the cerebral cortex. The

Figure 12.



Nystagmic Tract For Vertical Canals.
(Endolymph Movement Toward Ampulla.)

efferent tracts arise in at least three different regions of the cerebral cortex and pass down to the oculomotor nuclei. It appears that any return of nystagmus after injury to a part of the cerebral mechanism may be explained by supposing that the shorter, more primitive paths through the subcortical regions become passable for nervous impulses.

Any irritation to the labyrinth produces a peripheral labyrinth nystagmus. Any irritation of the vestibular nerve or its central ramifications produces a central vestibular nystag-

mus. It is most essential that these two forms of vestibular nystagmus be differentiated because they call for entirely different therapy.

1. A true peripheral nystagmus usually has one form; a horizontal or rotary and going in one direction. A central nystagmus may take various forms and directions. It may have a horizontal form on one side and a rotary on the other, etc.

2. Dizziness is always associated with peripheral nystagmus and its intensity corresponds to the degree of nystagmus. In central nystagmus, dizziness may or may not be present and bears no relation to the nystagmus. There may be a very marked central nystagmus which has no dizziness at all. Nausea or vomiting are usually associated with peripheral nystagmus in the same manner as dizziness. This is usually absent in central nystagmus.

3. Past pointing and falling are always opposite to the direction of the peripheral nystagmus. In other words, the patient past points or falls always in the direction of the slow component. The past pointing or falling may both be normal in central nystagmus.

4. The labyrinth symptoms, *viz.*, nystagmus, vertigo, past pointing, nausea, vomiting, depend upon the peripheral nystagmus: If it is marked, then these symptoms are aggravated; if the peripheral nystagmus has practically subsided, then the intensity of these symptoms has very much diminished. The labyrinth symptoms have no such relation to central nystagmus.

5. Another very important differential point is the time element. Peripheral nystagmus is limited by time because an irritated labyrinth is soon compensated by the sound labyrinth. The central nystagmus lasts as long as the central lesion and may last forever. The peripheral nystagmus usually diminishes from a few days to several weeks, whereas the central nystagmus may become stronger and stronger as time goes on.

The results obtained from the rotation test invariably give valuable information. Absence or only brief duration of nystagmus, after rotation, indicates a loss of function. This is found in the very late stages of suppurative labyrinthitis or

as a permanent condition in the deaf mutes. Excessive nystagmus with marked vertigo after a few turns usually means a labyrinth irritation. When a spontaneous nystagmus is present and, upon rotation the usual rotational nystagmus is not elicited, in other words, the spontaneous nystagmus remains, it is, therefore, logical to attribute it to some central lesion. Conversely, a nystagmus which is not present but must be elicited by rotation is almost necessarily of labyrinth origin. Changing the position of the head after turning does not alter the direction or form of the nystagmus. The patient fixing his gaze after rotation can normally shorten the nystagmus. It is wise to have the patient look at infinity after turning.

The diagnostic value of the rotation test is invaluable after all the vestibular symptoms have disappeared. We have noted that the influence of the endolymph movement toward the ampulla as compared with a displacement toward the non-ampullated end in the horizontal canals is two to one. After the destruction of one labyrinth in a long suppurative process, the rotational nystagmus toward the paralyzed side gradually approaches or finally equals that toward the sound labyrinth. This is known as the "compensatory phenomenon of Ruttin." In other words, the nystagmus, after rotation, is the same on both sides in duration and degree, in spite of the fact that one labyrinth is destroyed. This means that the labyrinth is well ossified, for if there was any viability in the labyrinth, the ratio would not be the same. The compensation is brought about by Deiter's nucleus. The importance of this phenomenon is to determine the proper time to operate.

Ocular nystagmus often presents difficulty to the otologists in differentiating it from vestibular nystagmus (Orlandino,[14] Duane[15] and G. MacKenzie[9]). The salient features will only be described. Ocular nystagmus is undulatory and its oscillations are equal in extent and rapidity, whereas in vestibular nystagmus there is a slow and rapid component. The direction cannot be determined because the components in ocular nystagmus are usually of the same rapidity; unlike labyrinth nystagmus, it is not more marked when looking toward the quicker component.

Congenital nystagmus, due to congenital pigment disease, is a cicatrization of the cornea before the child learns to fixate.

Fixation nystagmus indicates a retinitis pigmentosa choreodites, albinism, etc.

Coal miners' nystagmus, due to overstrain on the ocular muscles.

Spasmus nutans occurs in infants when unable to fixate because of the dim and dark surroundings.

Latent nystagmus: Cover one eye and the patient will have a nystagmus in the exposed eye because he cannot fixate. Remove the cover from the eye and then he can easily fixate with both eyes and the nystagmus disappears.

The more important ocular nystagmus that gives the otologist the most concern is the physiological and the paresis of the external rectus muscle. Physiological nystagmus is almost always present in every normal individual when they look into either lateral extremes for any length of time. The paresis of external rectus can easily be ascertained by the red cover test and other examinations. Clinically, a chronic running ear, right side, suddenly develops a nystagmus to the same side, a differential diagnosis must be made between an ocular nystagmus or a beginning labyrinth irritation. If the spontaneous nystagmus is vestibular, it would be constant and active in its early stage and in all directions. If the spontaneous nystagmus is physiological, it should disappear by having the patient look either to the left or forward. If the spontaneous nystagmus is vestibular, one would have the subjective symptoms of vertigo, nausea, vomiting, etc., whereas these are absent in ocular nystagmus. If the spontaneous nystagmus is vestibular, the intensity will be increased in looking in the direction of the quick component. This is not so in ocular nystagmus, etc.

There are two methods of choice for caloric reactions. The Kobrak [2, 16] method uses 10 cc. of cold water with temperature of 58° F. The Barany method is a continuous douche, temperature of 68° F. until the nystagmus is elicited. Both methods are universally used. The movement of the endolymph in the caloric test is best explained by a physical law. If heat or cold is applied to a vessel containing fluid, a movement is observed of the endolymph in the vessel, because of a change of specific weight gravity. If cold water is used, then the specific weight gravity becomes heavier and the direction of

endolymph would be downwards. Conversely, if hot water is used, the specific weight gravity of the endolymph in the vessel would become lighter, and the movement of the endolymph would be upwards.

In the caloric reactions, cold water is invariably used, as it is far more reliable than hot water. When hot water must be used it is generally given between 112° F. and 120° F. There is one strong indication for the use of hot water. Example: A running ear — right — suddenly develops a spontaneous nystagmus on the same side. It is important to know whether the nystagmus is coming from an irritated labyrinth or from some intracranial complication. Unable to test for the viability of the right labyrinth with cold water, fearing dissemination of infection, or because the presence of polypus, granulations or cholesteatomatous mass, etc., contraindicates its use. If the left ear (sound) were irrigated with hot water, and the right labyrinth in question were viable, then the nystagmus should change from the right side to the left side (the sound side). If the spontaneous nystagmus remains the same, *i. e.*, without any change, then we are dealing with an intracranial complication. The indication for this test in these cases renders it invaluable.

With the head in erect position, the anterior vertical and horizontal canals are stimulated, chiefly the former. Fig. 13 shows a cross-section of the canals and their position to the stream of water. With cold water 68° F., the endolymph movement is downward and application of the laws will have the following data: The nystagmus is rotary (Flouren's Law), because the current is chiefly through the anterior vertical canal and very little through the horizontal canal; so much so that the horizontal reaction is totally disregarded. The nystagmus is to the opposite side (Ewald's Laws 2 and 3). The current going from the nonampullated and to the ampullated end of the vertical canals is the lesser effective movement (Ewald's Law 2) and the lesser effective movement gives nystagmus to the opposite side (Ewald's Law 3).

Conversely, if hot water were used; Fig. 14 illustrates this clearly: Rotary nystagmus (Flouren's Law) to the same side (Ewald's Laws 2 and 3).

In order to bring the horizontal canal in alignment with the vertical stream of douching the head is tilted backwards

60°. The results are the same as above, with the exception of having a horizontal nystagmus instead.

It takes about 40 seconds to elicit a normal nystagmus, with a duration of about one and one-half minutes. The nystagmus here fulfills the same rules as the rotational nystagmus.

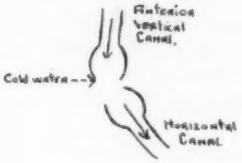


Fig. 13

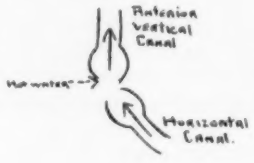


Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

Caloric test is absolutely contraindicated in traumatic and dry perforations. In these cases, it is best to use the device of Block and Aspissoff for introducing cold air. Ruttin's modification of Foen air apparatus appears well adapted for the caloric test with cold and hot air.

The caloric test is of no value in polypi, excessive granulations and cholesteatomatous masses in the ear.

The nystagmus elicited in the caloric test is of great clinical value. If the nystagmus starts early and the duration is longer than two minutes, then there are two possibilities: *1.* The temperature of the water is reaching the labyrinth

immediately, as may be found in perforation of the drum or after a radical mastoid. This does not mean a hyper-irritable labyrinth; *2.* If the drum is normal, then it is a sign of hypo-irritability of the labyrinth. It is very important to ascertain the irritability of the labyrinth before doing any radical operation on the ear.

Conversely, if the nystagmus starts late and the duration is curtailed, two possibilities arise: *1.* Any mass in the ear, wax, granulations, etc., preventing the temperature of the water in reaching the labyrinth. *2.* If the drum is normal, it is a sign of hypo-irritability of the labyrinth.

If the caloric tests elicit no vestibular responses, the labyrinth is either inhibited, as in severe serous labyrinthitis, or is destroyed, as in acute diffuse manifest suppurative labyrinthitis and latent suppurative labyrinthitis. In serous labyrinthitis, the caloric test will produce an irritation within a few days and operation is absolutely contraindicated. In acute diffuse manifest, and latent suppurative labyrinthitis, the response will always be negative and a labyrinth operation is under consideration.

During the course of a radical mastoid operation should the question of a possible labyrinth operation arise, and the labyrinth reaction prior to the operation was not ascertained, remove all pathology, and then do a caloric test. If the labyrinth is viable, a very marked vestibular slow reaction of the eyes is seen. The quick component is held in abeyance in general narcosis. If the labyrinth is alive, operation on same is absolutely contraindicated.

There has been much discussion as to the relative merit of both the rotation and caloric tests. Caloric test is far more delicate than the rotation. The rotational nystagmus, vertigo, etc., is far more violent because both ears are stimulated at the same time and the mechanical force of the turning produces a more violent endolymph movement. The rotational nystagmus is of shorter duration, about 24 seconds; whereas, the caloric nystagmus lasts about one to two minutes. The caloric test reveals the function of the labyrinth tested and also its degree, whereas, the rotational nystagmus is the summation of both labyrinths.

Fistula is not by any means uncommon in a large ear clinic. They chiefly occur in the horizontal canal, because of its exposure to the infective material of the middle ear.

Fig. 15 represents a cross-section of the horizontal canal in relation to the middle ear. Fig. 16 represents a fistula through the bony wall of the canal up to the membranous canal but not through it. Compression causes horizontal nystagmus to the same side while aspiration causes horizontal nystagmus to the opposite side (Ewald's Laws 1 and 3). This is typical in about 95 per cent of cases and called the typical fistula symptom. The other 5 per cent of cases gives a reverse fistula symptom, on compression, a horizontal nystagmus to the opposite side and, on aspiration, a horizontal nystagmus to the same side. Fig. 17 illustrates this reverse fistula symptom. The direction of the fistula is toward the nonampullated end, and stimulating the endolymph movement towards that direction in the horizontal canal results in a horizontal nystagmus to the opposite side (Ewald's Laws 1 and 3).

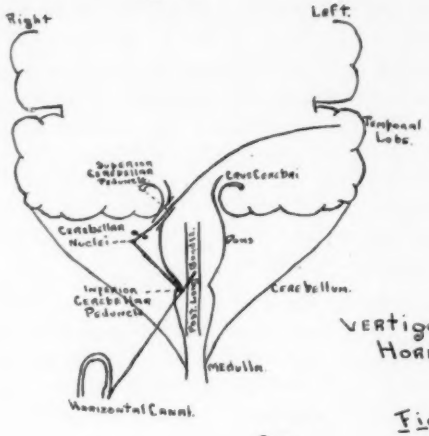
The failure to elicit a fistula symptom when present is always due to some obstruction in the tympanic cavity, such as granulations, thick secretions, cholesteatomatous masses, polypi, etc. This readily explains why a positive fistula symptom one day may be absent another day; therefore, failure to elicit a reaction on compression or aspiration will not positively exclude the presence of a fistula. When the fistula reaction is positive and yet the drum is perfectly normal, which presupposes no fistula on the horizontal canal, yet the rotation tests reveal a nystagmus between five to 10 seconds on either side, it is highly suspicious of congenital lues. This is called "Hennebert's symptom."

Vertigo is a very important symptom to the otologist and is intimately associated with nystagmus. The vestibular nerve in medulla oblongata divides into two parts: *a.* fibres from the horizontal canal; *b.* fibres from the vertical canals. The fibres from the horizontal canal go to Deiter's nucleus and here again divide into two tracts, one going to the posterior longitudinal bundle, forming the nystagmic tract, which has been fully described; the other going to the three cerebellar nuclei, namely, globosus, emboliformis and fastigii, through the inferior cerebellar peduncle (see Fig. 18).

The fibres coming from the vertical canals (see Fig. 19) shun Deiter's nucleus, pass inside the medulla and ascend to the upper part of the pons, where they divide into two parts: one portion going to the posterior longitudinal bundle, forming the nystagmic tract; the other going to the cerebellar nuclei through the middle cerebellar peduncle.

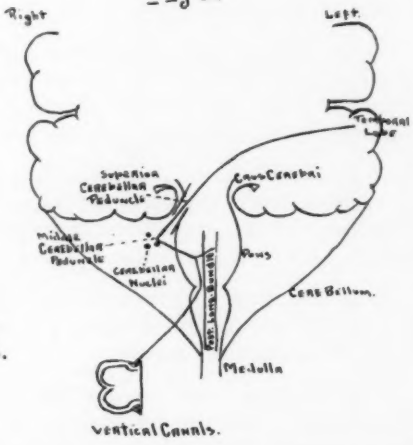
The fibres from the vertical and horizontal canals leave the cerebellum together through the superior cerebellar peduncle, enter the cerebrum through the crus cerebri and decussate

Fig. 18



VERTIGO TRACT FOR HORIZONTAL CANAL.

Fig 19.



VERTIGO TRACT FOR VERTICAL CANALS.

to the other side of the cerebral cortex, somewhere in the temporal lobe. In this area and beyond, the fibres cannot be definitely traced. Clinically, past pointing is dependent upon vertigo, so that there must be some association with the vertigo centre to the motor area.

Any condition that irritates or stimulates any portion of this vertiginous ramification causes vertigo. Vertigo is a false sensation of movement of surrounding objects. This movement may be systematized or nonsystematized. There are a great many factors producing this symptom; therefore, vertigo *per se* is unimportant, unless it is accompanied with nystagmus.

Spontaneous vertigo of vestibular origin is always accompanied by some degree of spontaneous vestibular nystagmus and is increased when the eyes are voluntarily turned in the direction of the quick nystagmic movement. Vertigo is in the same plane and direction of the nystagmus. The patient falls in the opposite direction of the nystagmus because this false impression is perceived as a true one, and he reacts against it by moving in the opposite direction.

Spontaneous vertigo ceases when the spontaneous vestibular nystagmus ceases. The intensity of the vertigo is proportionate to the intensity of the nystagmus. Labyrinth vertigo usually subsides within several weeks. Spontaneous vertigo existing over three months is suggestive either of intracranial lesion or neurasthenia.

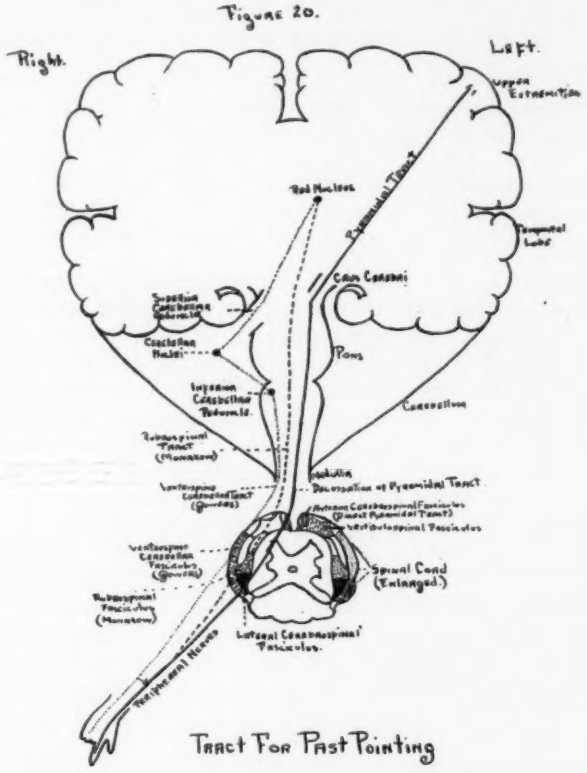
There is no proportion between vertigo and the nausea and vomiting that are usually associated with it. There are cases where slightly douching the ear produces marked nausea and vomiting with very little vertigo, and vice versa.

A gradual destruction of one labyrinth may not give rise to vertigo, due to the gradual compensation by other factors; however, sudden exacerbations in such chronic progressive conditions will cause vertigo.

It is true that vertigo can exist without past pointing or falling, yet, on the other hand, without vertigo there will be no past pointing or falling.

Past pointing is not an ear reaction or a cerebellar function as it is commonly understood; it is a cerebral motor act. Past pointing depends upon vertigo, and does not occur without it. This is an important point to remember. Fig. 20 illustrates the tract for past pointing. There are two paths for past pointing: The pyramidal tract and the spinovestibulocerebellar tract. The pyramidal tract starts in the opposite motor area of the upper extremity, passes through the inter-

nal capsule, then through the crus cerebri and enters upper part of the pons and decussates to the opposite side in the medulla oblongata becoming the crossed pyramidal tract. Passing down to the lateral funiculus of the spinal cord, the fibres pass out to the brachial plexus and are distributed to the muscles of the upper extremity. This tract has the energy and



power to move the upper extremity for pointing but is very awkward, for it lacks the synergic function of the cerebellum. This coordinated factor is given by the spinovestibulo cerebellar tract or the tract of Gowers. The impulse starts in the deep joints, tendons and muscles of the upper extremity and passes up into the lateral funiculus of the spinal cord, where the tract of Gowers begins; it ascends in the medulla

and passes into the cerebellum through the inferior cerebellar peduncle in the same neurilemma with the vertiginous fibres coming from the horizontal canal. From the cerebellum it passes up through the superior cerebellar peduncle to the red nucleus on the opposite side. Here the rubrospinal tract starts, which crosses again to the other side and down the pons and medulla to enter the lateral funiculus of the spinal cord. Here the peripheral fibres pass out with the crossed pyramidal fibres to the upper extremity where the synergic action is given.

The phenomenon of falling after ear stimulation may be regarded as past pointing of the entire body.

The impulses from the trunk muscles are carried by the dorsal spinocerebellar fasciculus or tract of Flechsig, through the inferior cerebellar peduncle to the vermis of the cerebellum.

The patient falls because of vertigo and not because he loses his balance, and will always past point and fall in the opposite direction of the nystagmus. This is very important to remember. The patient with a nystagmus to the left, tends to fall to the right. On turning his head forward he falls to the right; on turning his head to the right he falls backward; on turning his head to the left he falls forward. This, as a rule, is not true of intracranial lesions. If the intracranial lesion is on the left side, the patient falls to the left, regardless of the turning position of the head.

The Romberg test is merely a refined method of testing for spontaneous falling.

Fig. 21 is a cross-section of the cord, showing the principal fasciculi in the anterior and lateral funiculi that deal with past pointing and falling. They may be classified as follows:

I. Fasciculi in Anterior Funiculus; Descending Fasciculi: *1.* Anterior cerebrospinal fasciculus — direct pyramidal tract; *2.* vestibulo spinal fasciculus.

II. Fasciculi in Lateral Funiculus: A. Descending Fasciculi: *1.* Lateral cerebrospinal fasciculus — crossed pyramidal tract; *2.* Rubrospinal fasciculus (Monakow). *B. Ascending Fasciculi:* *1.* Dorsal spinocerebellar fasciculus — a direct cerebellar tract of Flechsig; *2.* Ventral spinocerebellar fasciculus or the tract of Gowers.

Thorough understanding of the nystagmic and vertiginous tracts and the proper interpretation of the labyrinth reaction are exceedingly important in the diagnosis of a central lesion (Sherrington,[19] Emil Villiger,[02] Jelliffe and White[21]). The following are some essential guides that help to differentiate a central lesion from a peripheral one (Pinaroli,[17] Ruttin,[18] Jones[12]):

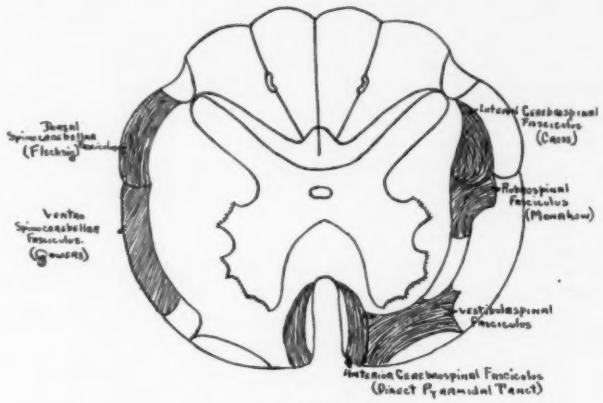


Figure 21.
Principal Fasciculi Of The Spinal Cord.

1. If the nystagmus increases instead of diminishing in intensity as in suppurative labyrinthitis, then it is of intracranial origin. *2.* With deafness and nystagmus of intracranial type and an intact tympanic membrane, a tumor along the course of the vestibular nerve is most probable. *3.* A chronic ear with spontaneous nystagmus on the same side suggests an irritated labyrinth or a cerebellar abscess. If the labyrinth is functioning, then the lesion is peripheral, but if the labyrinth is nonresponsive a cerebellar abscess is under consideration. *4.* Case with running ear and cerebellar symptoms suggests cerebellar abscess of otogenic origin. A case with cerebellar symptoms but intact drum points to a cerebellar tumor. *5.* Ninety-five per cent of all the abscesses of the posterior fossa give a central nystagmus. Roughly, about 2 per cent of all the abscesses of the anterior and middle fossa give a central nystagmus. *6.* One gets normal responses from the vertical canals, but impaired or absent horizontal responses

suggest central lesion. *7.* Spontaneous vertical nystagmus is pathognomonic of a central lesion and indicative of involvement of the brain stem from either infiltration or pressure. *8.* A perverted or inverse nystagmus is pathognomonic of a central lesion and is indicative of brain stem involvement. Perverted nystagmus means, for example, douching the horizontal canal and instead of obtaining a horizontal nystagmus, a vertical nystagmus is elicited. An inverse nystagmus is present when douching the right horizontal canal with cold water and a horizontal nystagmus occurs on the same side, instead of on the opposite side. *9.* If ear stimulation produces conjugate deviation of the eyes instead of nystagmus it is pathognomonic of a central lesion. *10.* Ataxia of the upper and lower extremity suggests a cerebellar lesion. Awkward movements of the trunk, swaying to and fro and backwards, is called "assynergie cerebelleuse Babinski" and suggests a lesion in the vermis.

The fundamental understanding of the mechanism of nystagmus and its concomitant symptoms will very often serve the otologist a very vulnerable position over his fellowmen.

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PRACTICAL POINTS ON SUBMUCOUS SEPTUM RESECTION: PITFALLS AND CORRECTIONS.*

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The submucous septum resection, after tonsillectomy, is perhaps the most frequent nose and throat operation; but it does not enjoy the reputation attained by other frequent operations — the good results. Operations on the septum will be skeptically accepted not only by the laity but also by many in the profession.

What are the reasons? Why do so many of these operated cases not obtain the well deserved success? To go into the causes and the individual methods of operating is not in the scope of this paper. I will try to evaluate my experience with about 2,000 submucous septum resections. These cases were operated on at the operative clinic of the Nose and Throat Department of the New York Post-Graduate Hospital during the last 12 years.

The S. S. R., per se, is one of the most difficult nasal operations and by inexperienced hands can be a plague to the patient for the rest of his life. This is a very exaggerated expression of opinion at which the expert surgeons would smile, yet if one looks through his own records he will find that there were cases during the course of years that frequently remained unsolved, due to the difficulty of the case or to the complexity of the circumstances which accompanied the operation. My aim is to try to analyze these difficulties and discuss their correction.

Submucous may not be successful due to: *a.* Wrong indication; *b.* not enough removal of the obstruction; *c.* operative and postoperative complications; *d.* neglected postoperative care.

The difficulty of advising the S. S. R. lies in the fact that very often we are dealing not only with the local obstruction

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(cartilage or bone) but with concurrent conditions which may be in the sinuses or hypertrophic turbinates. The physiological factor that the air current will be inhaled through the upper meatus and the exhalation is in the lower meatus will explain that high deviations will give more complaints than even large low spurs; therefore, removal of the large low spur without eradication of the small but high deviation will give a bad result. The whole nasal pathology is a *circulus vitiosus*. Correction of the septum without removal of concurrent conditions (sinuses, hypertrophied turbinates) may prevent the promised relief; therefore, if the above conditions are present an immediate good prognosis should not be anticipated. The individuality of the patient is very important, for many cases with marked deflections have never complained of any difficulty with their noses, while sometimes small deviations cause considerable distress.

Climatic conditions are very important, especially on the eastern seaboard. I have had the opportunity to observe that emigrants coming from countries with a dry and even climate never complained of any nasal difficulty before their arrival to this country, but settling down in the eastern part of the Atlantic states, they began to have trouble after a few months. This should be taken into consideration when giving a good prognosis.

Preparation of the cases, in my opinion, is of utmost importance. The submucous is a major operation, often with many unexpected complications; therefore, it should not be taken lightly but should be prepared carefully. Sodium amytal, 2 to 3 gr., or some other barbital preparation, should be given the night before and an hour or an hour and one-half before operation; morphine should be given to highly nervous individuals only. As to the anesthesia, it should be local. Exceptional cases can be operated on with avertin or ether intratracheal, but these cases should be very exceptional. The operation should always be done at a hospital. The patient should be in a semireclined position. In the sitting position, fainting of the patient is a common occurrence which is rarely seen if the patient lies down. Whether this observation is based on a difference of blood circulation or a change in the absorption of the anesthetic or is purely psychic, is hard to say; but while about 15 to 25 per cent of the patients will

faint if the packing is done in the sitting position, this can be reduced to almost nothing if the patient is semireclined. The anesthetic used is generally cocaine, pontocaine, nupercaine, etc. The strength of the cocaine is a very important question. I have observed many cocaine intoxications with the use of 10 per cent cocaine. For the last eight to 10 years we have used the Gese solution, 2 per cent cocaine, 0.35 per cent phenol in a normal saline, with perfect results. Whenever a patient complained of any pain it was due to faulty technique in packing rather than to the solution. In addition to this solution we used adrenalin 1/1000, about 1 dram to 4 drams of cocaine. Four packings on each side of the nose for 10 minutes should give a satisfactory anesthesia. When removing the packing one should be certain that nothing is left in the nose, for left over packing will cause postoperative bleeding, delay in healing, abscesses and probable sepsis. There are cases that cannot tolerate even this strength of cocaine, in which case pontocaine 2 per cent, nupercaine 2 per cent can be used. In case the patient shows symptoms of acute intoxication, the immediate removal of the packing and the further use of another anesthetic is indicated. The barbital preparation, given for its quieting reaction on the patient, has an antidotic effect on the cocaine. Severe intoxications have to be treated accordingly, with artificial respiration, injections of camphor, caffein, strychnine, or adrenalin. The use of morphine as an antidote is contraindicated.

Proper instruments should be used for the operation. All surgeons should work out their own technique and get accustomed to a set of instruments best suited to their own use. The instruments may be few or many, as necessary. An assistant is not important, but it is advisable to have a nurse present to give a helping hand.

Before the incision is made 1 per cent novocaine with adrenalin should be injected. A small pliable needle and lock syringe should be used. About 1 to 1½ cc. of novocaine should be injected under the mucous membrane; this will help the anesthesia, cause ischemia and will separate the mucoperichondrium from the cartilage.

The nostrils should be sterilized with 3 per cent tincture of iodine. The incision should be made on the side of the deviation, which is to the left in 75 per cent of the cases, and

should be adjusted to the formation of the septum. It should be in front if the deviation is anterior, further back if posterior, but always should come from the highest point down to the floor of the nose.

Proper separation is one of the most important steps of a good operation. Separating the wrong cleavage will cause bleeding and difficult operating. The pearly white, shiny cartilage against the somewhat reddish, dull mucoperichrondrium should be the leading point. The separation should start at the highest point of the incision where the smallest amount of connective tissue is between the cartilage and the perichondrium.

Bleeding while operating is one of the most common complications that prevent satisfactory work and may be caused by: *1.* A little or no adrenalin used; *2.* separating the wrong cleavage; *3.* tearing of the mucous membrane. Occasional arterial bleeding will be observed after the removal of the bony vomer. Minor bleeding usually stops with the use of pressure or adrenalin packing. Bone wax is to be used on the floor.

Breaking of instruments: If the broken part cannot be located an X-ray should be taken immediately, and further manipulations should be done under the fluoroscope until the foreign body is recovered. Cotton or gauze swabs must be removed and small bone or cartilaginous pieces should be cleaned out to prevent hematoma or secondary infections. I had occasion to remove a cotton plug six months after a submucous; fortunately, it did not cause much trouble, but the postoperative period was very long and drawn out.

Tearing of the mucous membrane, if one-sided, will not cause untoward consequences; but a tear of both sides of the mucous membrane, even a small one, will cause a permanent perforation that is occasionally very hard to correct. Large perforations withstand any operative correction, and will give a continuous complaint of scab formation, bleeding or whistling.

Removal of the cartilage and bone should be thorough, but some discretion must be used while operating. The removal of too much of the columna will cause a dropping of the

tip of the nose. A breaking of too much quadrangular cartilage or the upper part of the bony septum may cause a dropping of the bridge of the nose, which will not appear until months after the operation. I am a firm advocator of the Jansen-Middletown punch forceps for biting these parts, instead of a Demorest, which will break and may remove the whole holding pillar from between the two nasal bones, causing the nose to sink. The utmost importance should be paid to this technique, because these high deviations will prevent good results if left *in situ*. Many times this will be overlooked and only large spurs on the floor, that probably are not the cause of the difficulty, be removed.

When the operation is finished the operative field should be gone over once more to clean out all bone fragments, cotton plugs, or gauze sponges. Before the patient is put to bed the nose should be packed. There is a difference of opinion as to the packing to be used: Some use tight packing; some use suturing flaps without packing, and some use vaseline gauze. Many use Simpson splints, cigarette drains and rubber tubing, and vasenol packing gauze. All packing should be left in for 24 hours only; I have had occasion to observe acute ear infections when packing had been left longer. Besides, there is usually considerable discomfort for the patient, for packing in the nose will usually prevent the patient from sleeping without the use of hypnotics. About an hour-and-a-half after the operation there is some bleeding from the nose that can be accounted for partly by relaxation of the vessels after the use of adrenalin, and partly by trauma connected with the operation. This bleeding usually keeps up for a few hours; therefore, the patient should be advised to stay in bed in the sitting position, and ice compresses should be placed on the nose. There are exceptional cases of very severe bleeding that start only a few hours after the operation and originate from the sphenopalatine artery or one of its branches. In these cases tight packing of the nose and even postnasal packing will be required. These bleedings are generally parenchymatose and probably have a constitutional cause that will necessitate not only tight packing but the administration of thromboplastine intramuscularly, morphine, and even transfusion, etc. After 24 hours the packing should be removed and this will again cause some bleeding, which will stop if the patient remains quiet, and sits with the head

bent forward. A secondary packing is very seldom required. After this the patient's nose should be left alone for three or four days. Gentle blowing of the nose, one side at a time, should be advised. The use of ephedrine jelly or borated vaseline will help to relieve congestion. Secondary hemorrhage may take place a few hours after the removal of the packing or any time within two weeks after the operation; the reasons are obscure. Late bleedings are very unpleasant and may be caused by the removal of the healing scab or some other injury to the mucous membrane. These late bleedings may be so severe that hospitalization of the patient will be necessary. The blood should be examined in these cases because there may be some dyscrasia present.

Hematoma formations may take place in the first 24 hours in cases where no packing is applied, and later in cases where packing was applied over night. A small clot or piece of cartilage or bone between the flaps may cause these hematomata, resulting in hemorrhage and thus retard the process of healing. To prevent this, an opening in the flap of the floor of the nose will help. If a hematoma has formed, an opening should be made either in the original incision or on the floor of the nose; this will usually remedy the situation, although the hematoma is apt to reoccur. If large hematomata are present a secondary packing (Simpson, Burney splints) may be necessary. If the hematoma is not opened it may break down and cause septal abscesses, or remain partly absorbed, causing permanent thickening of the septum, and, therefore, further complaints. Too much cleaning of the nose or suction after the removal of the first packing is not a practical procedure, for the healing will be retarded and may cause late infection or other complications.

The septal abscess which is usually due to secondary infection of the hematoma is also a very unpleasant complication. Severe headache, temperature, and blocking of the nose are the usual symptoms. These abscesses should be promptly treated by surgical intervention. A wide opening should be made through the mucous membrane and kept open with a rubber or cigarette drain as long as pus is present. A nasal irrigation with some disinfecting solution should be used if necessary. No packing should be applied in cases of septal abscesses, as free drainage is absolutely essential.

Ear infections, after a submucous, may occur, due to the packing or a forced blowing of the nose. Gentle blowing of the nose, one side at a time, will usually prevent this complication.

Acute throat infections are quite frequent. Follicular tonsillitis, acute pharyngitis or staphylitis, due to mouth breathing, and possible stagnation of the mucus in the postnasal spaces will be the cause. In cases where a submucous and a tonsillectomy are to be performed the tonsillectomy should precede the submucous. The immediate postoperative period of the S. S. R. is afebrile. Cases where a rise in temperature is observed should be carefully investigated, as this may be a sign of secondary infection.

Anosmia can be temporary or permanent. The temporary anosmia usually disappears after a few days when the swelling has gone from the nose, but occasionally it remains permanently. In these cases the olfactory region has received some injury. Some of these cases may improve by galvanic or Faradic current, injections of strychnine or general roborants.

Meningitis, one of the dreaded complications of the S. S. R., is usualy of very short duration. The causes are not clear but are usually from some severe infection or possible injury to the cribriform plate. It is almost 100 per cent fatal. The therapy is palliative only, because the findings are negative.

One of the most common complications is perforation of the septum, due to rough or unskilled work. If the perforation is small a plastic repair can be done but if it is large, correction will be almost impossible.

The patient should be seen regularly for a few weeks after the operation to prevent synechia formations. The nose may be clogged up for two weeks after the operation, due to the sensitiveness of the mucous membrane, but the swelling will gradually disappear and normal breathing again be possible. Applying packings of argyrol, cocaine and adrenaline into the nose during the postoperative period is not advisable because of the irritation with consequent slow healing. Occasional edematous swelling may be observed in many patients, especially those with vasomotor tendencies. In these cases internal use of calcium and small doses of atrophine will be helpful. Always be certain that no cotton, gauze or hematoma is present.

A late complication of the S. S. R. is a dropping of the bridge of the nose (saddle nose), due to faulty removal of the cartilage and bone from between the nasal bones. This dropping will not be observed for months and sometimes years after the operation. Plastic surgery is then indicated.

Special consideration must be given to the S. S. R. of children. The rigid rule that no operation on the septum should be done until the nose is fully developed, usually at the age of 18 years, cannot be strictly adhered to; although the utmost caution must be exercised before this age. There are many cases that require an operative procedure as early as eight to nine years of age. In cases where the deviation is very marked and the nasal difficulties are severe, careful removal of the deviated cartilage or bone will be a great advantage to the general development of the child and, in turn, will help to ameliorate the local symptoms. The operation should be done under general anesthetic combined with the local use of a weak solution of cocaine and adrenalin. The parts to be removed should be as limited as possible to establish adequate nasal breathing. Radicalism, which is very important in adults, should be excluded when we are operating on a developing part of the body.

No operation should be done if acute infection is present, but a chronic infection does not contraindicate the S. S. R.

For the last 25 to 30 years very little has been written about the S. S. R.; therefore, I thought it would be advisable to relate my experience of late years. The points that are included in this article are merely practical ones and the conclusions drawn from the vast number of cases that have come under my observation during these years.

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THE DIAGNOSTIC AND PROGNOSTIC VALUE OF ANTRUM-IRRIGATED PUS.*

DR. L. R. EFFLER, Toledo.

We had a hard time deciding on the title of this paper. The one selected we considered almost too long, even for a scientific subject. The subject itself reminds us strongly of that superstitious practice of "reading the tea leaves" after the cup is drained. We can't very well entitle this essay "Reading the Tea Leaves," because that would sound a bit too popular for such a scientific body.

In effect, however, we are *"reading the tea leaves."* In this case, of course, we are *"reading the pus basin."* There is nothing superstitious about this latter practice because it has a very practical application.

Most of us have read numerous journal articles about the bacterial flora in sinusitis. The bacteria most frequently encountered by smear and culture are the *streptococcus*, both hemolytic and nonhemolytic; the *staphylococcus*, both aureus and albus; the *pneumococcus; M. catarrhalis; B. coli; B. proteus;* and the *diphtheroids.*

The average sinus practitioner cannot be expected to smear and culture every antrum-irrigate in a busy practice. He hasn't the time, even if he has the inclination. He must, therefore, learn quickly to read and recognize clinical evidence bacteriologically in the pus basin. The reason for this is twofold: First, the importance of *diagnosing* the germ with which he has to deal in order to know best how to cope with its activities; and second, the importance of *prognosing* from this information the probable time of his patient's disability.

For purposes of simplicity, we shall refer to the antrum-irrigated return flow as the *"irrigate."* Since the words *"filtrate"* and *"distillate"* have a very definite meaning in reference to filtered and distilled solutions respectively, we have taken the liberty of coining the word "irrigate" in a similar connection.

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*Read before the Eye, Ear, Nose and Throat Section of the Academy of Medicine, of Toledo and Lucas County, May 22, 1936.

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We do not wish to imply that every pus-containing "irrigate" contains a pure culture of a specific organism; we are rather of the opinion that it does not. We do feel, however, that one specific germ in most cases is in predominance, and that its predominating characteristics are clinically recognizable. After one or two irrigations, in most cases, the associated organisms may tend to disappear from the picture and leave the predominating germ in possession as almost a pure culture. It is the germ of prominence with which we have most frequently to deal.

Clinically, therefore, we believe we are safe in saying that we can recognize at least *six types of antrum infection by a study of the "irrigate";* others may recognize more. Our experience, however, covers the ordinary run of every day practice. What is said of the antrum may apply equally well, though in lesser measure, to such other monocellular sinuses as the frontal and the sphenoid.

These six types are:

ACUTE.

1. The Staphylococcus: This is not the most serious antrum infection, though it is probably the commonest. The first "irrigate" may be perhaps rather cloudy, but certainly in that "irrigate" you will find several lumps of pus which have the characteristic yellow or white color that identify the staphylococcus. From a *diagnosis* standpoint, you not only learn the identity of the affecting organism but also the extent of the infection. You recognize instantly by the cloudy "irrigate" and its scattered pus elements that the whole inside lining of the sinus is involved. The prognosis at this point is still uncertain.

After a second or a third irrigation, you may note that the cloudiness gives way to a clear "irrigate," in which the pus will "lump up" and plop out into the basin all in one mass. The latter is a good *prognostic* sign. It means that the infection has become localized in only one portion of the antrum. This localization is, of course, an indication of improvement. One is safe in concluding from this fact that complete recovery will be a matter of only a few weeks.

2. B. Pyocyaneus: This type of antrum infection is also rather common. Fortunately, it is one of those infections in

which "the bark is worse than the bite." The first "irrigate" is always profusely purulent, very murky, but of a distinctly *greenish* cast. The latter characteristic writes the *diagnosis*. We are dealing, of course, with our old friend of laboratory days — the bacillus of blue or green milk. Not very pathogenic, it yields rather promptly to subsequent and well judged irrigations. From a cloudy "irrigate" at first we soon encounter the clear and "lumping" character of pus that indicates improved *prognosis*. The same remarks that were made on this point with regard to the staphylococcus apply to the pyocyaneus bacillus infection.

3. B. Proteus: This is another type of antrum infection in which the "bark is worse than the bite." The organism is likewise not very pathogenic. The "irrigate" at first is also very cloudy and intensely *foul-odored*. The latter characteristic marks the *diagnosis*, inasmuch as the saprophytes account for the putrefaction in the discharge.

The *prognosis* is ordinarily good for fairly rapid recovery. As in the case of the staphylococcus and the pyocyaneus infections, a few well spaced irrigations will tend to dissipate the odor and cause the pus to "lump up" preparatory to its complete disappearance.

4. The Streptococcus: This type of antrum infection is found usually in a patient who is very sick. We have never yet been able to determine with certainty whether we are dealing with a straight streptococcus infection or with an influenza infection. The "irrigate" in both cases is very much the same; pus rather scanty, a trifle granular, and inclined to be a bit bloody. The ordinary irrigation with the three previously named organisms may be performed practically bloodlessly; the streptococcus or influenza "irrigate," however, has a distinctly sanguinolent character.

This type of antrum infection should be handled very judiciously. The temperature of 102°, 102.5° or 103° is much higher than is found in the ordinary sinus infection. Our patient's constitutional condition is usually in proportion. After a preliminary irrigation in which the *diagnosis* is established, it is well to keep hands off temporarily, pending any further complications. Certain it is that any meddling in the shape of too frequent or too injudicious irrigations will always be followed by constitutional reactions and temperature elevations. These reactions should furnish the hint that as little

tampering as possible should be done. It is well to let the *vis naturae medicatrix*, or healing power of nature, handle the situation as long as complications do not supervene.

The *prognosis* is governed partly by the temperature fluctuations and partly, when irrigations are necessary, by the altering character of the "irrigate." This means to say that, coincident with the fall in temperature and the general feeling of improved well-being of the patient, the sanguinolent character of the "irrigate" will disappear and the tell-tale "lumping" of pus will begin to appear.

CHRONIC.

5. Simple: This type comes to you not so much because there is a tremendous discharge of pus but because there is constant nasal trouble in the shape of stuffiness, mucoid discharge, alternating intumescence, and the like; transillumination and X-rays reveal an antrum that is dark.

The "irrigate" in such cases does not reveal much pus. It contains usually a few scattered cellular elements, is clear, *and marked by the presence of flakes and shreds;* much like urine in a certain stage of chronic urethritis.

The blotting out of light by transillumination and X-ray is explained by a thickened periosteum. The sinus has been acutely involved at some time in the past, but has done a fair job of self-healing. This type of sinus is better left alone after a preliminary puncture and irrigation. The best that will be gained by further irrigations is an acute flare-up or a superimposed infection. Attention is best directed to the nose, itself, in an effort to clear up its symptoms and prevent the recurrence of colds that automatically stir up the sinus in each case.

6. Mixed: This type of antrum infection is marked by long standing. Your patient speaks of an irritating discharge from one nostril that is verified by excoriation at the ala. He will not tell you of the *foul* character of the discharge, but his wife will whisper it in your ear when her husband's back is turned.

The "irrigate" in such a case is marked by a *milky pus of foul-smelling character.* These two characteristics mark the *diagnosis.* The reason for the milkiness, of course, is because the infection is of a *mixed type* in which are present almost every bacterium on the calendar. The reason for the foul odor is the presence of the saprophytes.

The *prognosis* is always bad for cure by simple irrigations. One is justified in trying simple irrigations for a time because occasionally these alone will suffice for a cure. Too frequently, however, such a sinus is marked by the presence of polyps that must be removed before the possibility of a cure will result.

This type of antritis will offer usually a grand opportunity for cooperation between Roentgenologist and sinusologist. Studies with lipiodol and every other means at command will prove valuable. Here, also, a grand opportunity offers for cooperation between dentist and sinusologist, where the possibility of a devitalized tooth enters the picture. We refer, of course, to upper second bicuspids and first and second molars. Lastly, the sinusologist is put upon his own in the matter of choosing from the whole gamut of operative procedures the one which most appropriately fits a particular case. A cure is within the realm of possibility. This involves disappearance of pus and freedom from malodorous discharge. A fine sense of surgical judgment is necessary to accomplish both.

SUMMARY.

We would like to emphasize the following points:

1. Sinus "irrigates" should not receive the "sink test" too quickly. It is not enough to say that "the sinus is or is not involved" in this or that case.

2. Sinus "irrigates" should be studied carefully though quickly. We should *"read the pus basin"* seriously as some *"read the tea leaves"* superstitiously.

3. Sinus "irrigates" will yield valuable gross bacteriologic information as to diagnosis and prognosis in at least six clinical varieties of antrum infection.

4. Sinus "irrigates" studied in this way will make practice more scientific, more pleasurable, and more satisfactory, both to specialist and patient alike. The patient is thus given a better opportunity of becoming interested in his own case, as the evidence is right before his eyes in the pus basin just as it is before the doctor's. It is all "above board," so to speak. The doctor has the onus put upon him in each succeeding irrigation of showing a diminishing amount of pus. He must answer for success or failure in this regard, both to himself as well as to his patient.

222 Michigan Avenue.

ELLIOTT TREATMENT OF SINUS DISEASE.*†

DR. FRANK L. BRYANT, Minneapolis.

Fever therapy in some form is becoming the popular and accepted treatment of diseases arising from infection, although not very long ago it was considered proper to "break a fever"— to bring the temperature down. Antipyretic treatment received the commendation of Claude Bernard and Virchow about 1845. However, increased knowledge of physiology and pathology and the questionable results obtained by endeavoring to lower the fever have prompted many of us to reconsider this attitude. It may be safely stated that proponents of antipyretic therapy are treating a result of infection and not the infection itself. In fact, it would seem that the fever Nature produced and the accompanying phenomena within the tissues are decidedly helpful rather than deleterious. Welsh, in 1888, definitely stated he believed fever was an aid to the body in fighting infection.

As a therapeutic aid fever therapy is not new, although the means and administration of today have changed considerably from those of our predecessors. In Rome and Pompeii hundreds frequented the hot baths or "thermae." They also could be found in a like form in ancient Turkey. Heated dry air at a temperature of 133° F. to 140° F. was also employed. Another old mode was that of hot fomentations used by the Japanese. The Egyptian practice of baking may be considered as another phase. The adage that there is nothing new under the sun still holds true.

There are numerous ways of producing fever: It may be a local or general procedure and, likewise, the effects may be local or general. Injection of a foreign protein, either specific or nonspecific, is familiar to all of us. The need for less abrupt, severe, and fleeting effects has given impetus to the manufacture of electromechanical methods. They have the advantage of being more easily watched and controlled.

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†From the Department of Otolaryngology, University of Minnesota Medical School.

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Let us consider the rationale of fever therapy. Does it simulate Nature's reaction to infection? Is it a helpful feature?

When infection is introduced into any given location within the body there occur certain physiological responses. If the organisms are virulent the reaction is prompt and extensive; on the other hand, if the bacteria are of low virulence the body responds slowly and with little or no external evidence.

In inflammation there are three distinct phenomena which occur. They are: *1.* Alteration of tissues (degeneration to necrosis); *2.* exudation or vascular changes (plasma and leukocytes); and *3.* proliferation — the reaction on the part of the fixed tissue cells.

What is the effect of fever therapy upon normal tissue? In the experiment in which the distal end of a rabbit's ear is placed in hot water there is an immediate vascular response. If the water is hot enough and the ear is allowed to remain in the water sufficiently long, the alterative and proliferative reactions are seen to occur. The first or vascular reaction becomes more marked. This is organism's response to degeneration and necrosis and its aid in carrying nutrition of greater quantity to the fixed tissue cells which aid in healing.

It appears, therefore, that the vascular response is the key factor in Nature's fight against infection. This dominant phenomenon in inflammation, the change in the blood vessels and their contents, is most striking and characteristic. Theoretically, a means by which this phase can be augmented should be of distinct value. It would tend to lessen the alteration of the tissues and increase the proliferative process.

Before Nature can successfully have proliferation and healing of a part which is the site of an infection, some mechanism must be present to gradually overcome the injury and insult to the tissues. The dilatation of the blood vessels releases into the tissues an exudate similar to the blood plasma; in it the protective substances and bodies are believed to be conveyed to fight the infection. In addition, it is held that the exudate will dilute and wash out the infective agent. Cellular elements are likewise present; they, too, aid in combating the infective agent.

The ideal method would be that which definitely and positively destroys the invading bacteria. As they can be killed

by heat in vitro, such could not be possible in vivo as the thermal death point of most pathogenic bacteria is too high. Some strains of staphlococci are killed at 80° C. for 30 minutes; others at lower temperatures; pneumococci at 52° C. for 10 minutes and some strains of streptococci at from 55° C. to 65° C. for 60 minutes. Attempts to carry this out would produce alterative changes far too severe. Even if such could be accomplished it would be injurious to the immune substances and bodies present in the exudate. The activity of the leukocytes would be impaired. Antitoxin is rendered inactive at 65° C. to 75° C. A temperature of 56° C. for one-half hour destroys blood lysins and alexins. Opsonins are rendered inert after being subjected to a temperature of 54° C. Hence, heat to this extent would be more deleterious than helpful. Moreover, it would be unbearable to the patient.

From the foregoing it must be evident that an optimal vascular reaction is desired. In other words, fever therapy, if and when it is to be used, should augment what the body is already trying to do in its fight against infection.

The problem chosen for study was to determine in what type of sinus infection, if any, the Elliott treatment would and could be of value. Favorable reports in gynecologic studies and the premise that this method augments the vascular phenomenon prompted the investigation. It was also decided to treat all types of nonallergic infection — that is, acute, subacute and chronic — and evaluate the findings. One may well ask, "Would not spontaneous healing occur in a certain number of patients?" The answer is, obviously, "Yes." However, all the patients treated were seeking relief from definite complaints and it was felt that this preliminary study would indicate which group received the most aid. There were no complications developing in any group. Those which seemed most relieved would be the subject of further investigation (such is now being carried out). In addition, the study of the reaction of heat on the action of the cilia, character of the discharge, and leukocytosis are likewise being considered.

The Elliott treatment consists essentially of a closed circulating flow of heated water. The rate of flow or pressure and the temperature are both under control and may be modified as is indicated. The treatment is not difficult to use; it is well tolerated by the patient. No untoward results or compli-

cations of any kind occurred in our series. The treatments are given daily.

The nose is inspected before each treatment; any excessive secretion is removed by cannula suction. A dry pencil-pledget of cotton is inserted along the floor of the nose. On this is placed the rubber applicator, in the collapsed state, lubricated with tragacanth or k-y jelly. This places the applicator in the region of the middle meatus anteriorly and superior meatus posteriorly. The tubes extending from the regulator to the

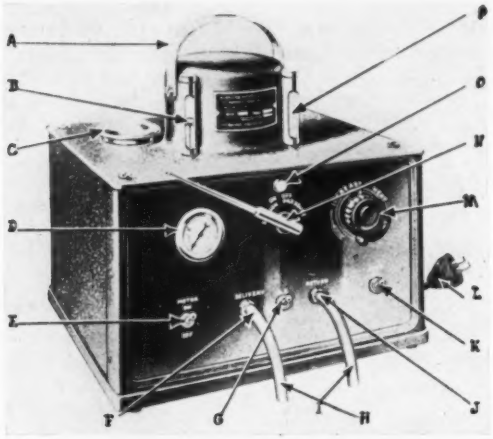

Fig. 1. (A) Handle. (B) Water level indicator. (C) Opening for filling. (D) Pressure indicator. (E) Motor switch. (G) Current switch. (F, H, I and J) Tubing to be connected to applicators. (K) Heat switch. (L) Applicator plug. (M) Thermostat control. (N) Pressure control. (O) Pilot light. (P) Thermometer.

applicator are supported by a suspension apparatus. The pressure is gradually turned on, the water having been previously heated to the desired temperature, usually beginning the treatment at 120° F. and increasing it to 130° F. and in some 135° F.

The number of treatments vary from eight to fifteen in any one series. The patient is in a recumbent position; the head is tilted slightly forward. No other form of treatment was used in conjunction with this method. Patients were advised not to use nasal oil in any form.

At the completion of a treatment, the nose seems more stuffy to the patient, but not painful or distressing. Examination at this point reveals the membrane more red and with an increased amount of secretion. The patient is asked to rest for one-half hour before going out, especially during cold weather.

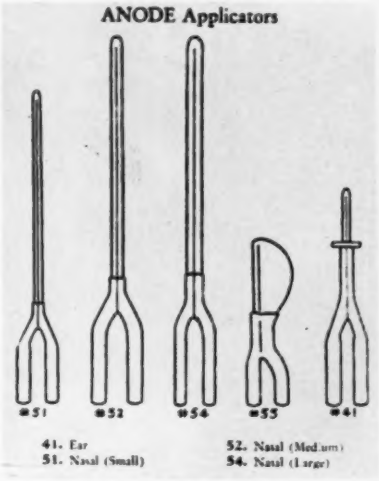

Fig. 2.

CASE REPORTS — ACUTE SINUSITIS.

Case 1: Miss H. T., aged 25 years, stenographer, Jan. 8, 1936. CC.: Head cold. Sharp pains over right side of face and under right eye. Fullness in right cheek, especially upon stooping or bending. Thick discharge in back of nose and throat. The above symptoms present continuously for past two weeks.

Examination: Marked injection of mucous membrane of right nasal cavity; cavity filled with thick mucopus. Right middle turbinate reddened and enlarged and obliteration of right middle meatus. Left nasal cavity: Clear and slight redness of mucous membrane. Right antrum does not transilluminate. Ears: Normal. Eyes: Normal.

Treatment: Eleven Elliott treatments, right side only, Jan. 8 to Jan. 20.

Results: At completion of third treatment, patient states there is "less pain in eye and cheek;" of sixth treatment, "no pain in eye, cheek, or upon bending;" of tenth treatment, "feels fine, nose clear, very little discharge."

X-ray Report, Jan. 8 (taken before treatment): "Marked blocking out of ethmoids and maxillary on right side; the right frontal shows some change; left side, all clear."

X-ray Report, Jan. 20, taken immediately after last treatment: "Definite improvement seen; slight cloudiness of right maxillary. All other sinuses are clear."

Check-up, April 17: Nose clear and free from discharge since last seen. Feels very well generally.

Case 2: R. D., schoolboy, age 13 years, Sept. 12, 1935. CC.: Head cold with profuse nasal discharge; discharge into throat; difficulty in hearing. The symptoms, as stated, have been present from Aug. 15 to Sept. 12 (day of examination).

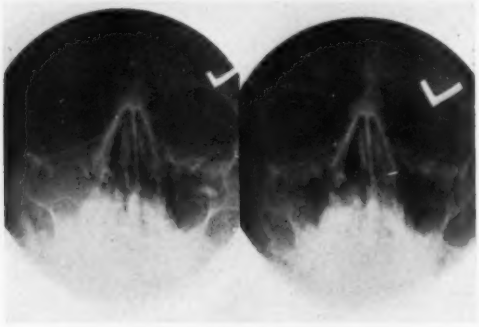

Fig. 3.

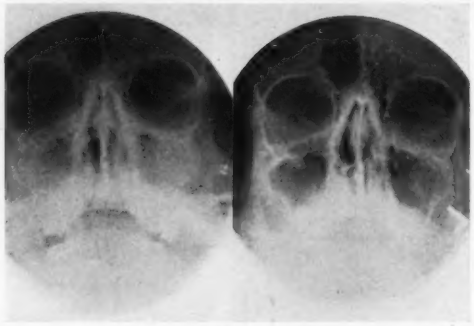

Fig. 4.

Examination: Mucous membranes markedly injected; both middle turbinates swollen and obliteration of middle meati. Nasal cavities filled with mucopus. Maxillary antra do not transilluminate. Ears: No change in tympanic membranes but loss of 15 units by audiogram. Temperature, 100.4° F.

Treatment: Twelve Elliott treatments, bilateral. Treatments given from Sept. 10 to Sept. 27.

Results: After each treatment patient stated he felt better; corroborated by mother.

X-ray Report, Sept. 10: "Purulent pansinusitis, left side; right maxillary and ethmoid cloudy on right side."

X-ray Report, Oct. 8: "Marked clearing on left side; residual thickening in maxillary, ethmoid, and frontal on left side. Slight thickening in right maxillary and ethmoid."

Examination, Oct. 10: Nose clear, little redness of mucous membranes; slight postnasal mucus discharge. Oct. 21: Nose clear, no redness, no postnasal discharge. Maxillary antra transilluminate clearly. April 8: No head cold or nasal difficulty since last seen. Nose: Normal. Hearing: Normal.

Case 3: C. W., schoolboy, aged 12 years, Sept. 22, 1935. CC.: Headache. Severe head cold with yellow discharge from nose and into throat. According to mother, complaints present from Aug. 1 to Sept. 20; he is frequently feverish and very uncomfortable.

Examination: Mucous membranes markedly injected; all turbinates very swollen and meati obliterated. Nasal cavities filled with yellow mucopus. All sinuses dark on transillumination. Temperature, 100.8°.

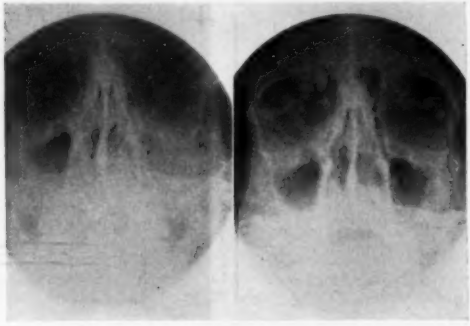

Fig. 5.

Treatment: Twelve Elliott treatments, bilateral, Sept. 23 to Oct. 8.

Results: After fifth treatment patient said he was beginning to feel better; after ninth treatment the nose was free from discharge and the patient felt much improved.

X-ray Report, Sept 20: "Marked blocking out of left maxillary sinus suggesting granulations; also of right maxillary. Frontals are normal. Ethmoids are cloudy."

X-ray Report, Oct. 11: "Marked density has disappeared. Residual thickening in both maxillaries."

Examination, Oct. 8: "Nose clear, very little secretion; mucous membrane pink. All sinuses transilluminate clearly (frontals small in this patient). Oct. 22: Nose clear; patient feeling fine.

Case 4: Mrs. S. T., housewife, aged 28 years, June 22, 1935. CC.: Headache in forehead for past three weeks; earache, periodic, for past two weeks. Discharge of pus from nose and down throat. Difficulty in breathing through nose.

Examination: Marked redness of mucous membranes of nose; nasal cavities filled with mucopus. Maxillary sinuses do not transilluminate. Temperature, 99.6°.

Treatment: Eight Elliott treatments, bilateral, from June 23 to July 2.

Results: After the fourth treatment the headache had abated and there was less discharge. After the seventh, the mucous membranes were less injected. The left antrum transilluminated quite clearly, the right showed some light.

Examination, July 9: Little redness of mucous membranes present. Middle turbinates somewhat enlarged but no redness. X-ray taken in June, 1933: Thickening of mucous membranes of maxillary sinuses; cloudiness of both ethmoids.

Case 5: R. V., schoolboy, aged 15 years, Nov. 18, 1935. CC.: Severe head cold and nasal stuffiness. Discharge from both ears since last head cold two months ago. According to mother, patient has had "running ears" since infancy.

Examination: Nose: Marked redness of mucous membranes; nasal cavities filled with sticky mucopus. Throat: Diffuse redness of pharynx and nasopharynx. Ears: Canals filled with purulent exudate—removal reveals almost complete loss of tympanic membranes. Previous X-rays: Diagnosis, "chronic mastoiditis." Taken in 1934.

Treatment: Twelve Elliott treatments, bilateral, Nov. 19 to Dec. 5.

Results: After twelfth treatment nose was essentially free from discharge; nasal mucous membrane showed only little redness. Mother instructed to use "dry wipe" treatment to ears.

Examination, April 6, 1936: Nose: Some redness present of mucous membrane of left nasal cavity but little mucus seen. Right ear is dry and left ear had some mucopus present. Mother had been instructed to use boric acid-alcohol drops and dry wipe method in interim.

Case 6: Mrs. M. B., housewife, aged 36 years, July 10, 1935. CC.: Severe headache in center of forehead. Head cold and nose filled with sticky mucus for eight days.

Examination: Mucous membranes markedly injected. Nasal cavities filled with yellow mucopus. Pharynx and nasopharynx show diffuse redness. Postnasal discharge of mucopus. All sinuses transilluminate very clearly. Temperature, 99.4°.

Treatment: Ten Elliott treatments, bilateral, from July 10 to July 23.

Results: With each treatment headache gradually subsided until completely gone at end of eighth treatment. Nose gradually became clearer and less discharge present.

Examination, Aug. 8: Patient feels fine; no nasal discharge or stuffiness. Sept. 26: Patient stated she had a slight head cold five days ago which lasted for two days. Nose: Some redness of mucous membranes and sticky mucus in middle meati (no treatment). Oct. 24: No further trouble since last seen; patient has felt fine; no headache or nasal discharge.

SUBACUTE SINUSITIS.

Case 1: Mrs. M. L., housewife, aged 32 years, March 3, 1936. CC.: Headache in forehead and above nose. Discharge from nose for several weeks.

Examination: Moderate redness of mucous membranes of nose. Right middle turbinate hypertrophic and red. Right frontal sinus darker than left on transillumination. Right antrum did not transilluminate; left, clear. Temperature, normal.

Treatment: Six Elliott treatments, bilateral, from March 4 to March 10.

Results: At end of sixth treatment right antrum was clearing and headache had practically subsided (patient did not complete prescribed series; called out of city by death in family).

Case 2: Mrs. G. H., housewife, aged 35 years, Oct. 3, 1935. CC.: Inability to breathe through nose, especially right side. Sticky mucus discharge from right side. Complaints date from head cold four to five weeks ago.

Examination: Mucous membrane moderately injected. Right middle turbinate is hypertrophic and right middle meatus obliterated; sticky mucopus in each nasal cavity, especially on right side. Temperature, normal.

Treatment: Ten Elliott treatments, bilateral, from Oct. 4 to Oct. 18.

Results: After sixth treatment less obstruction noted in breathing. After tenth treatment, nose was clear, minimal amount of nasal discharge.

Examination (six weeks later): Nose has remained clear and has some mucus discharge from right side of nose at times.

Case 3: Miss A. S., clerk, aged 31 years, Jan. 8, 1936. CC.: Headache, especially in forehead, temples and about right cheek. Discharge of mucus to thick mucopus in back of nose and down into throat for past two months. Complaints followed head cold at that time.

Examination: Mucopus in both nasal cavities; mucous membranes show moderate redness throughout; both middle turbinates are moderately hypertrophic. All sinuses dark on transillumination. Temperature, normal.

Treatment: Twelve Elliott treatments, bilateral, Jan. 8 to Jan. 20.

Results: After tenth treatment headache practically subsided; completely gone after twelfth treatment. Discharge present at end of ninth treatment but much less in amount.

X-ray Report (before treatment): "Marked thickening of mucous membranes of maxillary sinuses; also thickening of ethmoid and sphenoids. Frontals are small and show no change."

X-ray Report (after treatment): "Less thickening of mucous membranes, especially on right side."

CHRONIC SINUSITIS.

Case 1: M. M., farmer, aged 65 years, Nov. 5, 1935. CC.: Frontal headache. Unable to breathe through nose. Discharge from nose and into throat for many years — at least 10 years.

Examination: Both middle turbinates very large and hypertrophic and both middle meati completely obliterated. Thick mucus discharge and crust in both nasal cavities. Antrums darkened on transillumination (both antrums had been irrigated on previous occasions without any benefit).

Treatment: Ten Elliott treatments, bilateral, from Nov. 6 to Nov. 20.

Results: Possibly less headache after third treatment. After tenth treatment less discharge but more crusting observed.

Examination (four weeks later): Complaints the same. Intranasal findings essentially the same.

Case 2: E. C., janitor, aged 55 years, June 8, 1935. CC.: Headache in right forehead. Thick discharge from right side of nose and also into throat.

Examination: Right middle turbinate greatly hypertrophied. Right middle meatus completely obliterated. Mucopus and crusts in right nasal cavity.

Treatment: Ten Elliott treatments, right side, from June 13 to June 27.

Results: Less discharge for three weeks after treatments but headache persisted. A second series of ten Elliott treatments, right side, was given. Patient stated he felt no better after completion of second series.

X-ray (after twentieth treatment): Showed positive changes in right frontal and ethmoid sinuses.

Case 3: W. L., unemployed man, aged 35 years, Feb. 18, 1936. CC.: Headache in left side of forehead and left eye. Nasal discharge, especially from left side. All present for several months.

Examination: Mucous membranes moderately red. Hypertrophic middle turbinates. Profuse mucopus in both nasal cavities. Frontal and maxillary sinuses darkened on transillumination.

X-ray (Feb. 18): "Bilateral frontal and maxillary sinusitis."

Treatment: Eight Elliott treatments, bilateral, from Feb. 19 to Feb. 27.

Results: At end of seventh treatment he said he had some less headache but more drainage. Twelve treatments were prescribed — patient did not return for further treatments. No record of patient since then.

Case 4: O. H., farmer, aged 57 years, Oct. 10, 1935. CC.: "Catarrh of nose for most of life; difficulty in breathing through nose at times."

Examination: Thickened and red mucous membrane of both nasal cavities, which were filled with some thick mucopus. Right middle turbinate enlarged. Both antrums were darkened. X-ray: Diagnosis: Chronic maxillary sinusitis.

Treatment: Twelve Elliott treatments, bilateral, Oct. 10 to Oct. 25.

Results: Discharge less during last four treatments; also for about two to three weeks after treatments. Six weeks after last treatment patient stated he felt some better but did not want to take second series.

Case 5: A. J., unemployed man, aged 49 years, Oct. 28, 1935. CC.: Headache in frontal area. Frequent head colds; discharge from nose and into throat for several years.

Examination: Mucopus and crust throughout nasal cavities. Cleansing revealed markedly enlarged middle turbinates. Frontal sinuses darkened and maxillary sinuses show no light on transillumination.

X-ray (before treatments), Oct. 10: "Chronic pansinusitis, left; chronic maxillary sinusitis, right."

X-ray (after treatments), Nov. 26: "Chronic pansinusitis, left; chronic maxillary sinusitis, right."

Treatment: Twelve treatments, bilateral.

Results: Patient noted no improvement after any of treatments. Advised to have another series but decided he did not have enough help.

Case 6: J. S., farm woman, aged 43 years, Nov. 7, 1935. CC.: Pain in left forehead and side of face. Yellow discharge from nose, especially left side.

Examination: Mucous membrane of nose moderately red, especially on left side. Nasal cavities filled with purulent exudate and crusts. Cleansing revealed large swollen middle and inferior turbinates. Both middle meati obliterated. All sinuses darkened on transillumination.

X-ray (before treatments): Chronic pansinusitis, bilateral.

Treatments: Twelve Elliott treatments, bilateral, Nov. 7 to Nov. 26.

Results: After tenth treatment headache and pain in side of face had almost subsided. On fourth day after last treatment had a dull occasional ache in left forehead.

Examination (two weeks after last treatment): Patient felt she had some help from headache but thought discharge was about as profuse as previously. Intranasal findings essentially the same. No change in transillumination.

Case 7: J. W., unemployed man, aged 59 years, Feb. 13, 1936. CC.: Discharge from nose into throat; inability to breathe through nose. Headache and pains in forehead and temples. Complaints have been present for several years.

Examination: Nasal cavities filled with mucopus and some crusts. Mucous membrane red and thickened. Sinuses on left side and right maxillary do not transilluminate clearly.

X-ray, March 4: Chronic pansinusitis, left, and right maxillary sinusitis.

Treatment: Thirteen Elliott treatments, bilateral, Feb. 17 to March 4.

Results: At end of ninth treatment patient said he had less headache. At end of thirteenth treatment patient had noticed no other change in condition. Intranasal examination showed more crusting, otherwise findings were essentially the same.

ACUTE EXACERBATION OF CHRONIC PANSINUSITIS.

Mrs. M. V., aged 50 years. CC.: Pain and swelling of "left eye" (this patient had left eye removed years ago for intraocular tumor). Nasal discharge and inability to breathe through nose (left side).

Examination: Swelling and redness of left periorbital tissues. Mucopus filled left nasal cavity. Removal of discharge revealed very red mucous membrane and hypertrophied left middle turbinate. Left frontal and maxillary sinuses do not transilluminate. Temperature, 99.6° F.

Treatment: Six Elliott treatments from Feb. 25 to March 3. Ten treatments from April 15 to April 26.

Results: Patient stated that with end of each treatment pain was lessened. Swelling subsided moderately but not completely after sixth treatment; no pain at end of series but mucopus continues, though not as profuse. Essentially the same results with second series.

X-ray (after treatments): Chronic pansinusitis, left side.

SUMMARY AND CONCLUSIONS.

1. Fever therapy is a natural adjunct in Nature's fight against infection. It helps to augment the vascular phase of inflammation.

2. A study of 17 patients comprises the basis for this preliminary report. Six patients had acute sinusitis; three, subacute sinusitis; seven, chronic sinusitis. One presented an acute exacerbation of a chronic sinusitis.

3. The patients with acute sinusitis showed the greatest improvement. This was shown by symptomatic, clinical and X-ray findings.

4. Those with subacute sinusitis improved, but not as promptly as in the group with acute sinusitis.

5. The group with chronic pansinusitis received no apparent lasting benefit from this type of therapy.

6. A single patient with an acute exacerbation of a chronic sinusitis received symptomatic relief.

7. The Elliott type of fever therapy would seem to have its greatest usefulness in the treatment of acute sinusitis.

8. Further study should be made with this form of therapy.

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FOREIGN BODY IN BRONCHUS SIMULATING CARCINOMA. REPORT OF A CASE.*

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The value of bronchoscopic examination in pulmonary disease is definitely established, especially in suppurative conditions. The alert internist and the trained bronchoscopist are also ever watchful for an overlooked or forgotten foreign body as the etiological factor in these conditions; however, not very often does one think of foreign body in a case presenting the picture of pulmonary neoplasm.

That foreign body in a bronchus may simulate carcinoma is demonstrated by the following case:

J. S., Hebrew, age 59 years, married, a plasterer by trade, was admitted to the Jewish Hospital, Medical Service of Dr. J. Rosenthal, on Feb. 11, 1936.

His chief complaints on admission were: *1.* Shortness of breath and wheezing for the past eight months. *2.* Bloody sputum with intervals for eight months. *3.* Rise of temperature, especially in the evening, as high as 102°. *4.* Pains in the right loin, radiating into the right upper back. *5.* Headache occasionally.

The patient said that he had never been sick, but for the past 10 years he had a cough without any acute illness. Eight months before admission he had pneumonia of the right lower lobe and was confined to bed for three weeks. After he was up for about two weeks he began to have pain in the lower back again, expectoration of blood-stained sputum, and periodic fever. He felt sputum of bad odor in his mouth and noticed fever, especially after exertion. Nocturia four to five times.

The salient physical findings were impaired resonance at the right base with moderate or subcrepitant rales, and a few

*From the Medical Service of Dr. Joseph Rosenthal and the Otolaryngological Service of Dr. Philip Leibowitz, Jewish Hospital, Brooklyn, N. Y.

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rales at the left base. There was dullness in the right interscapular region.

X-ray of the chest was done on Feb. 13, 1936. The following report was received from Dr. Rein: There is a slight haze over the right lung field with evidence of mottling. The left lung field reveals a rather dense opacity involving the upper two-thirds. The findings are highly suspicious of the presence of a bronchopneumonic infiltration.

A diagnosis of malignancy cannot be made.

There is also evidence of a dense bilateral hilum infiltration.

Dr. J. Rosenthal made the following note on Feb. 13:

Trachea not absolutely fixed, but not freely movable. No glands in subclavicular region and neck. Substernal tenderness. No cardiac displacement. No enlargement of heart.

Little increase of dullness subclavicularly on the right side. Tenderness on percussion over right lower lobe. Slightly diminished breathing over right base — a few crackling rales.

Positive Murphy on right side.

Stomach soft — liver enlarged one finger below costal margin. Right costophrenic angle tenderness.

Extremities — clubbing of fingers and curving of nails.

Impression: Neoplasm of the lung to be considered.

Dr. L. Loewe made the following note: The clinical picture suggests pulmonary neoplasm, although X-ray report is equivocal. The possibility of atelectasis due to bronchostenosis accounting for the X-ray picture must be borne in mind.

The urine examination was negative.

Blood examination:

R.B.C.	5,360,000	Hgb. — 90%
W.B.C.	Feb. 14, 1936	Feb. 24, 1936
Total	8,300	8,800
Polys.	80%	68%
Lymph.	16%	24%
Monos.	4%	
Eosin.		2%
Bas.		6%

Klein test — negative.

Sputum examination:

Feb. 11: No Curschman spirals — no fungus — smear and antiformin — no tubercle bacilli.

Feb. 15: No spirals, no Charcot Leyden crystals. Streptococcus hemolyticus, diphtheroid, bacilli, B. coli.

Intravenous pyelography, performed Feb. 17, was negative.

This case was seen in consultation by one of us (B. W.) on Feb. 13 and bronchoscopy was advised.

We bronchoscoped the patient Feb. 20. The following was the report at that time: No. 9 bronchoscopic tube used. Larynx normal. Right bronchus normal. Trachea and left main bronchus injected mucosa. At lower part of the left main bronchus the mucosa is thickened and wedged around a foreign body, which is very hard, irregular and brittle. The mass was removed. It was a gray-green calcareous foreign body, measuring 0.5x0.4x0.4 cm.

It is our impression that the man aspirated some lime or calcium during his work and it became lodged in the left main bronchus.

Desire bronchoscopy next week.

Re-X-ray on Feb. 23: The upper half of the left lung reveals a generalized mottling and also a generalized haze, suggesting the presence of infiltration. The right lung passages are clear.

The cardiac shadow is within normal limits of size, shape and position. — Dr. Rein.

We rebronchoscoped the patient on Feb. 27: The following note was made: Findings negative except that mucosa of left bronchus is slightly hemorrhagic.

Latest inquiries reveal that the patient has stopped coughing and that he has shown definite improvement.

From the history in this case we have good reason to suspect that this piece of plaster had been in the patient's lung for about 10 years, the patient disregarding the cough with no attempt being made to investigate its cause until after an acute episode, which was diagnosed as pneumonia. Such a history is not at all uncommon in cases of overlooked or forgotten foreign body.

Hill[1] reported cases of unsuspected foreign body in the bronchi which were treated for some time before removal of foreign bodies as pneumonia, tuberculosis, asthma and chronic bronchitis.

There is a group of cases in which, because of the character, size and shape of the foreign body, after initial acute symptoms have subsided, it may lie dormant in the bronchus for a long time. It is generally conceded that such foreign bodies remain constant and potential sources of danger and invariably lead to difficulty. Apropos of this Moersch[2] reported a case of a screw which had been in the lung for 34 years and which was not removed until the patient had developed pneumonia and then empyema. This patient had also been considered as having an underlying tuberculosis.

Lilienthal[3] reported a case of shell fragment in the lung for 15 years. He removed it by external operation.

The various signs and symptoms of pulmonary dysfunction and disease may be produced by a foreign body, and it is well for the physician to keep this possibility in mind when studying such cases.

A case which perhaps most closely simulates ours was reported by Maytum and Vinson.[4] It was that of pulmonary calculus simulating primary bronchial carcinoma. In reporting this case they make a statement which is very appropriate for our case, namely, "One of the characteristic features of primary bronchial carcinoma is the Roentgenographic evidence of an infiltrating lesion radiating from the hilum of the lung. Tuberculous or inflammatory lesions may give rise to shadows identical with that of carcinoma, and if the organisms of tuberculosis cannot be demonstrated in the sputum, it is necessary to make a bronchoscopic examination before the exact character of the lesion can be determined."

It may be pertinent to mention here that endoscopy is not only valuable in the diagnosis of malignant conditions but especially, and as we have seen in our case, in happily excluding such conditions. In this respect Negus[5] says he has often been asked to examine patients suspected of carcinoma of the lung and has been able to exclude this, finding simple bronchitis only.

We might mention here that the object of this paper is not to present anything new in diagnosis and treatment but rather to emphasize the importance of forgotten foreign bodies in the consideration of obscure chest conditions.

In discussing overlooked foreign bodies, Gittins[6] says many and often fanciful diagnoses were made and very serious

symptoms developed in most instances before the correct diagnosis was made. Several times patients were brought for bronchoscopic study by the parents or friends against the advice of the attending physician.

How many patients go to their death because of unrecognized foreign bodies, in the bronchi especially, can only be surmised. To forget foreign body as a possible diagnosis in any obscure case is not inexcusable. That it is forgotten justifies the report of this case. Unless the physician has the possibility in mind and closely questions his informants, a valuable clue may be lost. Richards[7] says that: "In the absence of a history or in the face of its denial, he must still be unconvinced and unwilling to disregard foreign body until either X-ray or bronchoscopy, or both, have been exhausted. Many times his suspicions will prove unfounded and an unexplained cough will be due to chronic bronchitis, or recurrent vomiting, to dietary imbalance; but from time to time, with foreign body in his mind as a possibility, he will make a brilliant diagnosis, and may even save a life."

Mention of the more pertinent and salient facts in diagnosis will not be inappropriate at this time.

Jackson[8a] in discussing bronchial foreign body says that initial symptoms are coughing, choking, asthmatoid wheeze. At once, or after a symptomless interval, cough, blood-streaked sputum, metallic taste or special odor of foreign body may be noted.

The physical signs vary with conditions present in different cases and at different times in the same case. The signs of diagnostic importance are chiefly those of partial or complete bronchial obstruction.

The following is very pertinent, as it will be recalled that most of the physical signs in this case were on the right side, although the piece of plaster was removed from the left main bronchus: "Rales in case of complete obstruction are usually most intense on the uninvaded side; in partial obstruction they are most often found on the invaded side distal to the foreign body, especially posteriorly, and are most intense at the site corresponding to that of the foreign body."

In discussing obstructive foreign bodies, he says that bones, animal shells, and inorganic bodies after months or years

produce changes which cause chills, fever, sweats, emaciation, clubbed fingers, incurved nails, cough, foul expectoration, "in fact, all the symptoms of chronic pulmonary sepsis, abscess, and bronchiectasis. These symptoms and some of the physical signs may suggest pulmonary tuberculosis, but the apices are normal and bacilli are absent from the sputum. Every acute or chronic chest case calls for the exclusion of foreign body."

It will be noticed that the simulation of carcinoma of the bronchus is not specifically mentioned.

He[8b] also makes the following pertinent statement: "The time of aspiration of a foreign body may be unknown, having possibly occurred in infancy or during sleep. The object may enter the lower air passages without the patient being aware of the accident. In many other cases the accident had been forgotten."

Arbuckle,[9] in discussing the clinical diagnosis of primary cancer of the lungs, says that to add to the difficulty most of the typical signs and symptoms are those which may accompany other pulmonary disease and in the late stages of the disease, metastasis and secondary changes help further to obscure the diagnosis.

Very significant is the following statement which he makes: "As the lesion encroaches upon the lumen of the bronchus, the patient may develop an asthmatoid wheeze, the result of a partial obstruction of the bronchus, similar in a way to that described by Jackson years ago in his book on the diagnosis of foreign body in the bronchus." (The latter reference is to Jackson's "Peroral Endoscopy and Laryngeal Surgery.")

McCrae,[10] in speaking of the clinical features of the bronchial neoplasms, says the onset may be insidious. Cough is the most common symptom. Wheezing may occur exactly as in the case of foreign body and should always excite suspicion. Pain and hemoptysis are important symptoms. Dyspnea varies with the stage at which the patient is seen. Loss of weight and strength with cachexia occurs late and is of no help in the early recognition of the disease.

The physical signs are diversified and there is no set picture that can be drawn. We have in the beginning nothing more than a slight irritation of a bronchus and in the late stages complete obstruction of the bronchus with suppuration, and

perhaps involvement of the lung and mediastinum. With all grades of change in between, it is evident that the picture may vary tremendously.

That foreign body in the bronchus and carcinoma of the bronchus may have similar symptoms and signs is evident from the above discussion. It will also be evident that proper study of obscure chest cases requires, as has often been repeated, the combined efforts of the internist, the radiologist, the thoracic surgeon, the bronchoscopist, and the clinical pathologist.

That the above statement is no exaggeration is evident when we realize the number of conditions which must be taken into consideration in the differential diagnosis of foreign body.

Sneller[11] says that dyspnea with physical signs of bronchial obstruction, for which no adequate explanation can be made, suggests foreign body. This may, however, be produced by bronchial tumor, bronchial polyp, peribronchial malignancy invading the bronchial lumen, involvement of the peribronchial lymph glands by tuberculosis, Hodgkin's disease, malignancy, etc., diphtheritic membrane in the tracheobronchial tree, external pressure by pericarditis with effusion, viscid secretion of bronchitis in certain contagious diseases and mediastinal compression by enlarged thymus.

Pulmonary tuberculosis, which is so frequently thought of first with chronic pulmonary pathology, usually begins in the apices. It is rarely found at the base where most of the lung changes occur as the result of the long sojourn of foreign body. Sputum is negative for tubercle bacilli.

Drowned lung may be mistaken for empyema.

Norris and Landis[12a] in discussing foreign bodies in the air passages say that the majority of mistakes are made in those cases in which the foreign body has been lodged for some time. They emphasize the fact that a definite history of the accident is very frequently absent. In the differential diagnosis they consider tuberculosis, abscess, and bronchiectasis.

Carcinoma of the bronchus is not mentioned.

Norris and Landis[12b] in discussing primary carcinoma of the bronchi and lungs consider the following conditions in the differential diagnosis: Tuberculosis, pulmonary abscess, loculated empyema, aneurism of the arch of the aorta, pleural

effusion, pericardial effusion, and massive collapse, due to bronchial obstruction.

Foreign body of the bronchus is not mentioned.

CONCLUSIONS.

1. Foreign body in the bronchus may simulate carcinoma of the bronchus. This should be kept in mind in the differential diagnosis.

2. It should be recognized that foreign bodies may enter the bronchi and cause no immediate symptoms. This is of paramount importance in the history and diagnosis of foreign body cases.

3. Complete and proper study of obscure chest cases requires teamwork amongst the internist, the bronchoscopist, the radiologist, the thoracic surgeon, and the clinical pathologist.

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PNEUMONOGRAPHY.*†

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The Roentgenologic study of the tracheobronchial tree following the introduction of radiopaque substances has become a widely employed procedure. This method of study was first practiced, in 1905, by Chevalier Jackson, who introduced bismuth subcarbonate powder through the bronchoscope. Yankauer, Lynch, Stewart and others also introduced radiopaque substances into the air passages to study diseases of the lungs. The procedure was not extensively used, however, until 1922, when Forestier and Sicard developed "lipiodol," an iodized oil for lung mapping. The importance of their discovery was immediately recognized as a valuable addition to the diagnosis of diseases of the chest, and it received wide attention. Pneumonography with iodized oil was quickly adopted everywhere, resulting in a better understanding of the physiology as well as pathology of lung diseases.

In the Bronchoscopic Clinic bismuth subcarbonate and iodized oil are employed for mapping the lungs. The powder, although used infrequently, has some advantages. It is quickly eliminated, usually within a few days. Clerf has employed it to study suspicious foreign body shadows in the periphery of the lung and to determine the relation of such shadows to a bronchus. Bismuth subcarbonate powder can be used to outline strictures of the trachea and bronchi. The powder should be chemically pure and dry, and should not be employed in the presence of excessive secretions, as it may form a paste and act as a foreign body. The powder is best introduced through the bronchoscope with a Clerf insufflator.

Iodized oil is a thick liquid containing 40 per cent iodine by weight in a vegetable oil. It is clear and light amber, and has a high specific gravity. The iodine forms a compound with oil and cannot be detected by ordinary reagents. The preparation is relatively inert; we have not encountered seri-

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†From the Bronchoscopic Clinic, Jefferson Hospital, Philadelphia.

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ous after-effects following its use. The most common untoward result is the occurrence of a mild iodine rash, coryza and a slight systemic reaction. This may be confused with measles. The iodized oil may remain in the lungs for many months before it is entirely eliminated, but this of itself is not harmful.

The method of instillation of the iodized oil into the air passages is of minor importance, providing the desired result, a good pneumonogram, is obtained. Various procedures are employed, depending largely upon the individual making the study. We prefer the bronchoscopic and catheter methods for instillation of the oil. The bronchoscopic method of instillation has been described by Clerf and others and no mention of it is necessary. In the catheter method employed in the Bronchoscopic Clinic the oil is introduced through a catheter previously inserted through the larynx. Two types of rubber catheter are used, a Coudé and a Thompson catheter having a curve almost at right angles at its distal end. For all ordinary purposes the Coudé rubber catheter gives very satisfactory results. The firmness and angulation of the tip facilitate the placement of the catheter into either main bronchus and very often into the bronchial subdivisions. For mapping of an upper lobe the catheter with the wide curve is used to better advantage. If there is a large amount of secretion in the tracheobronchial tree, the pneumonography should be preceded by postural drainage or by bronchoscopy.

In adults, the catheter is introduced through the mouth either by direct or indirect laryngoscopy. A 5 per cent larocaine solution is used for local anesthesia and to abolish the cough reflex. This anesthetic is nonnarcotic and nontoxic and in our experience can be safely employed in both children and adults. When indirect laryngoscopy is employed the pharynx is first anesthetized with a 1 per cent cocaine solution and about 3 cc. of a 5 per cent larocaine solution are instilled into the larynx and trachea. The catheter with stylet is then introduced under mirror guidance, through the larynx into the trachea. The stylet is withdrawn and the catheter is gently inserted further, so that it enters one of the main bronchi. If the patient is not sufficiently anesthetized, more of the larocaine is instilled through the catheter. In adults, we occasionally introduce the catheter by direct laryngoscopy. This is usually after a bronchoscopy

has been performed. In such instances, before the bronchoscope is withdrawn, the larocaine is instilled into the bronchi through an aspirating tube. In children, the catheter is always introduced by direct laryngoscopy, larocaine being instilled after the catheter is in place. The catheter is never inserted through the nose because this is not in accord with methods generally employed in the introduction of tubes into the tracheobronchial tree.

Fig. 1. This patient was treated for chronic cough for six months. X-ray studies suggested bronchiectasis, left lower lobe. Iodized oil was instilled by the catheter method with fluoroscopic guidance. It was impossible to get any of the oil to enter the left lower lobe. At bronchoscopy, the left lower lobe bronchus was found to be narrowed. There was observed a lesion on the inner and anterior bronchial wall. A biopsy was taken. Pathologist reported squamous-cell carcinoma. This case illustrates the diagnosis of bronchial obstruction by pneumonography and also shows the importance of further studies to determine the etiological factor. If bronchoscopy had been resorted to first it would have been unnecessary to do a pneumonography.

With the catheter *in situ*, the patient is sent to the fluoroscopic room. By fluoroscopic guidance the catheter may be placed in the desired bronchus without difficulty. The abolition of the cough reflex is determined by manipulation of the catheter; additional larocaine solution can be introduced if necessary. Iodized oil is slowly instilled and its progress is determined by the fluoroscopist. As in other methods of instillation, the position of the patient on the fluoroscopic table

is of importance in outlining a particular bronchial subdivision. It is desirable to have stereoscopic films as well as a lateral and films made with the Bucky diaphragm.

The catheter method has certain advantages over others. With fluoroscopic aid the oil is constantly observed, and there is little danger of too much oil being introduced. The accurate mapping of a particular bronchus or bronchial subdivision is possible. An X-ray study can be made on the fluoroscopic table, immediately after the oil is introduced, without disturbing the patient. Co-operation between the Roentgenologist and the physician instilling the oil is possible and is desirable.

Pneumonography should be used as a supplement to bronchoscopy in the study of pulmonary disease. The indications for its use should be determined largely by careful clinical, Roentgenologic and bronchoscopic examinations. The importance of this is best illustrated by a study of bronchial obstruction. If the latter is incomplete, iodized oil may go beyond the obstruction and give very little information concerning its nature. If complete, the oil will be stopped by the obstruction and nothing will be learned concerning the character of the obstruction or the pathologic changes that have taken place distal to it (see Fig. 1).

Pneumonography is of value in the study of the following conditions: Bronchiectasis; cystic disease of the lung; pulmonary abscess; bronchial stenosis and strictures of the trachea or bronchus; bronchopleural and bronchoesophageal fistulae; suspected foreign body shadows in the periphery of the lung.

Thoracic surgery owes much of its development to pneumonography. It has contributed a great deal to the present day concept of lung disease.

SUMMARY.

The use of a catheter to instil iodized oil into the tracheobronchial tree permits of accurate placement if done under fluoroscopic guidance.

Local anesthesia obtained with 5 per cent larocaine is excellent to abolish the cough reflex. It is nonnarcotic and nontoxic and can be employed both in children and adults.

Careful clinical, Roentgenologic and bronchoscopic examinations should determine indications for pneumonography.

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LINGUAL THYROID.*†

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The following is the continuation of the Bibliography to the article, "Lingual Thyroid," by Dr. Lewis T. Buckman, which appeared in the October, 1936, issue of THE LARYNGOSCOPE. The third and final installment of the article will be published in the December issue.

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SUMMARY OF CASE REPORTS

	Author	Year of Report	Sex	Age	Duration	Location on Tongue	Symptoms	Appearance
1	Hunt, Wm.	1866	F	16	5 years	Base	Dysphonia, dysphagia, dyspnea	Reddish, vascular, elastic, not fluctuating
2	Hickman, Wm.	1869	F	Newborn	Congenital	Base	Dyspnea	Firm, rounded, circumscribed
3	Merton, A. (Also reported by Lucke, 1869)	1879	M	22	Childhood	Base	Dyspnea	Firm
4	Parker, R.	1881	F	16	.....	Root and dorsum	.....	Firm, elastic
5	Weinlechner	1881	F	62	1 year	Base	Dysphagia	Elastic, not fluctuating
6	Bryant, T.	1883	F	18	For years	Base	Dysphonia, dysphagia, hemorrhage	Vascular, smooth, fluctuating
7	Bernays, A. C.	1888	F	17	.....	Base and intralingual	Dysphonia, dysphagia	Smooth, bulging in submental space
8	Wolf, R.	1889	F	18	6 years	Base	Sensation of foreign body, dysphagia	Firm, fixed
9	Butlin	1890	F	32	1 year	Base	"Discomfort"	Rounded, smooth
10	Butlin	1890	F	27	.....	Base	Dysphonia, dysphagia	.....
11	Staelin, A.	1892	F	77	.....	Base	Never observed until routine autopsy	Size of walnut, solid
12	Warren, J. C.	1892	F	52	22 years	Base	Irritation, obstruction	Size of hen's egg. Vascular
13	Warren, J. C.	1892	....	....	.....	.....	.....	.....
14	Warren, J. C.	1892	F	21	.....	.....	.....	Size of last phalanx of ring finger
15	Kast-Rumpel	1893	F	....	.....	Base	.....	.....
16	Baber, C.	1894	F	16	9 months	Base	Dysphagia, dysphonia	Size of small walnut. Vascularized

(CHRONOLOGICAL).

Treatment	Histological Examination	Outcome	Endocrinal Influences	Thyroid in Normal Position
Strangled by ligatures in situ	Not made	Death	.....	.....
None	Adenoma	Death	.....	.....
Removed	Thyroid tissue	Recovery	.....	.....
Removed	Adenoma	Recovery	.....	.....
Removed, suprahyoid route	Thyroid tissue	Postoperative death 4 days from pyemia	.....	.....
Incised	"Blood cyst," although drawings look like thyroid tissue	Discharged still with growth present	.....	.....
Removed, suprahyoid route	Thyroid tissue	Recovery	.....	.....
Course of iodine internally and locally. Aggravation of tumor. Tracheotomy	Thyroid tissue	Recovery	.....	.....
Removed	Cystic tubular adenoma (thyroid)	Partial recurrence 8 months	.....	.....
Removed by snare	Cystic tubular adenoma (thyroid)	Recovery	.....	.....
.....	Thyroid tissue	.....	.....	No abnormality of thyroid gland itself
Removed through mouth	Thyroid tissue	Recovery	First appeared after birth of youngest child, no change thru catamenia	.....
Removed by another surgeon 20 years before	Thyroid tissue	.....	.....	.....
No operation	Not examined	.....	.....	.....

No history given, simply an illustration of such a tumor found after death in old age According to Chamisso de Boncourt, quoting M. B. Schmidt, this case is identical to Staelin's.

Removed by galvanic snare	Thyroid tissue	Partial recurrence 2 months later	.....	.....

SUMMARY OF CASE REPORT

Author	Year of Report	Sex	Age	Duration	Location on Tongue	Symptoms	Appearance
17 Galisch, A.	1894	F	24	Intralingual, removed 1 year before	Base (2nd or recurrent)	Dysphagia, feeling of foreign body, hemorrhage, dysphonia	Filled the pharyn
18 Lake	1894			Mentioned similar case to Baber's in discussion.			
19 McIlraith, C. H.	1894	F	17	Observed first when singing master examined her throat	Base	.....	Size of walnut, semi-elastic, fixe
20 Powers, C. A.	1894	F	31	2 years	Base	Aphonia	Size of plum, rounded
21 Mixter (Cited by Storrs)	1895	F	24	3 weeks	Base	No difficulty	Size of hazelnut
22 Kraske	1897	F	36	.....	Base	Dyspnea	Size of hen's egg globular, soft
23 Lympius, M.	1897	F	36	2 years (probably many)	Base	Slight dysphonia, dysphagia, hemorrhage	Size of plum, elastic; smooth mucosa
24 Seldowitsch, J.	1897	F	14	Some months	Base	Dysphagia	Size of cherry, rounded, smooth
25-Lefferts 26	1898			In abstracting Seldowitsch's case, he remarks that he has seen two cases, both of which were never published.			
27 Reintjes, J. H.	1898	M	25	From childhood	Base	Dysphonia, hemorrhages	Dark brown, elastic, smooth, vascular
28 Treitel	1898	....	....	.....	"On the tongue"	Slight dysphonia	"Tumor on the tongue," smooth mucosa, reddene
29 Van Selms	1898	F		In the discussion of Reintjes' report, van Selms reported a case with a growth at the base of the tongue which had developed following thyroidectomy.			
30 Aschoff, L.	1899	F	6 mos.	.....	Root	Found at autopsy	Swelling composed of numerous small cavities filled with colloid
31 Benjamins, C. E.	1899			His case listed by Leulier, Köhl, et al., but it is simply a detailed description of Reintjes' case.			
32 Hausemann	1899			At the December, 1898, meeting of the Berlin Laryngological Society, he showed a preparation with a thyroid tumor developing on the base of the tongue. No clinical details.			
33 Hamilton, T. K.	1899	M	56	.....	Base	Dysphagia	Large, smooth, vascular
34 Holmes, C. R.	1899	F	....	.....	Base	Dysphonia	Size of hen's egg Dark purplish, smooth, soft
35 Mayer, E.	1899	M	....	.....	Base	Suffocating attacks	.....

(CHRONOLOGICAL).

Treatment	Histological Examination	Outcome	Endocrinal Influences	Thyroid in Normal Position
Prelim. tracheotomy; removed by pharyngotomy and section of thyroid bone	Thyroid tissue	Recovery	.....	No abnormality of median lobe
.....	.....	.....	.....	.....
Removed by dissection and snare	Thyroid tissue	Recovery	.....	Normal
Removed through mouth	Thyroid tissue	Recurrence 8 months later, removed	.....	.....
Removed by median pharyngotomy	Thyroid tissue	.....	.....	.....
Preliminary tracheotomy, removal	"Substantiated the diagnosis"	de Boncourt reported that 4 months later myxedema had developed	Cretin	Completely absent
Preliminary tracheotomy, lateral pharyngotomy	Thyroid tissue	.....	.....	.....
Removed by galvanocautery snare	Thyroid tissue	Myxedema, 7 months later	.....	Absent
.....	.....	.....	.....	.....
Preliminary tracheotomy, removal by mouth	Thyroid tissue	Postoperative myxedema	.....	Absent
None because of fear of hemorrhage	None	.....	.....	.....
.....	.....	.....	.....	.....
.....	Intercommunicating cysts containing colloid	.....	Cretin	Completely absent
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
Portion Removed	Tubular adenoma. Likened it to cases of Butlin, Bernays, Bland Sutton.			
Shrinkage by galvanocautery	Sarcoma. "But I have had cases that did not turn out to be what the microscopist reported."			
Potassium iodide	.....	Tumor thought to be specific	.....	.....

SUMMARY OF CASE REPORTS

	Author	Year of Report	Sex	Age	Duration	Location on Tongue	Symptoms	Appearance
36	Michael, J.	1899			In Heymann's "Handbook": "A thyroid of the base of the tongue has been removed by Roser."			
37	Mikluicz	1899			In Heymann's "Handbook": He mentions case of his in a young woman.			
38	Narrath	1899			Cited by Benjamins. No clinical details.			
39	Schadle, J. E.	1899	F	25	6 months	Base	All mental	Size of English walnut, normal mucosa, vascularized
40	Schadle, J. E.	1899	F	23	10 years	Base	Dysphonia, dysphagia, cough	Size of hen's egg, smooth, dense, dusky, red, resilient
41	Watson, A. W.	1899	F	50	8-10 years	Base	Dyspnea, dysphagia	Large, rounded
42	Watson, A. W.	1899	F (Negress)	16	5 years	Base	Dysphagia	Large, rounded
43	Posthumus—Meyjes	1899	F	24	"Always"	Right side of base	Felt she had a potato in her mouth	Smooth, fixed, painless, size of small nut
44	Vallas, M.	1900	F	20	.....	Base	Dysphagia, dysphonia	Size of small nut
45	Wakabayaski	1900	F	20	3 months	Base	Transitory hoarseness, dysphagia	Pigeon's egg, half globular, smooth mucosa
46	Theisen, C. F.	1901	F	67	1 year	Base	Feeling of lump in throat	Smooth mucosa. Deep red, not hard
47	Curtis and Gaudier	1902	F	21	5 years	Base	Dysphonia, dysphagia	Size of nut
48	Gaudier and Chevalier	1902	F	20	3 years	Base	Dysphonia	Size of chestnut, smooth, fixed, elastic
	(The second case reported in the same article and by some authors since counted as another report, is the same case reported by Curtis and Gaudier.)							
49	Goris, M.	1902	F	36	29 years	Base	Dysphonia, dyspnea, dysphagia	Hemispherical, vascular
50	Ingals, I. F.	1902			In discussing Shurly's paper, mentioned a similar case he had seen not long before.			

(CHRONOLOGICAL).

Treatment	Histological Examination	Outcome	Endocrinal Influences	Thyroid in Normal Position
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
Electrolysis resulted in hemorrhage, removed by median pharyngotomy	"Gland of the thyroid ductless type"	.....	Swelling during suppressed menstruation of the puerperium	.....
Refused operation	.....	.....	.....	.....
Portion removed	Cells arranged in alveoli with delicate stroma	.....	.....	.....
Removed by electrocautery snare	Cystic thyroid tissue undergoing colloid degeneration	Recovery	.....	.....
Refused operation	Not made	.....	.....	.....
Subhyoid approach but could not locate it. Delivered it into mouth and drained it. Then transhyoid route, complete removal.	Thyroid adenoma	Cured	.....	.....
Extirpation	Thyroid tissue	Recovery	.....	.....
Thyroid tablets for 6 weeks, not removed	Not made	No improvement	.....	.....
Removed thru mouth	Thyroid tissue	Had previously recurred after morcellement and cauterization	.....	Small
Transhyoid route, only partial removal because of absence of thyroid	Thyroid tissue	Recovery	Enlarged during menstruation	Absent
Prelim. tracheotomy, mobilized the tongue, removal thru mouth	Thyroid tissue	Recovery. Postoperative myxedema	Menses delayed to 21	.....
.....	.....	.....	.....	.....

SUMMARY OF CASE REPORTS

	Author	Year of Report	Sex	Age	Duration	Location on Tongue	Symptoms	Appearance
51	Shurly, E. E.	1902	F	16	2 years	Base	Constant desire to swallow	Small hen's egg, dark red, globular, smooth
52	Smith, T. L. (Cited by Smyth, H. E.)	1902	F	48	.....	Base	.....	Walnut-sized, vascular, firm, elast
53	Teweles, F.	1902	F	13	5 years	Base	Snoring, hemorrhage, dysphonia	Elastic, smooth
54	Winslow, R.	1902	F	17	.....	Base	Dysphonia, dysphagia	Smooth
55	Carpenter, G.	1903	F	14	.....	Base	Discovered accidentally, dyspnea	Elastic
56	Hanzel, F.	1903	F	50	20 years	Base	Dysphonia, dyspnea, dysphagia	Size of small apple, reddish, vascular, filling pharynx
57	Onodi A.	1903	F	26	.....	Base	Dysphagia, sleeplessness	Size of hazelnut, hard
58	Crandon, L. R. G. (Cited by Storrs)	1904	F	9	18 months	Base	Dyspnea (nocturnal)	Size of a nut, smooth, elastic
59-63	Erdheim, J.	1904			Five cases of aplasia of the thyroid gland, all with growths in the root of the tongue.			
64	Finder	1904	F	21	.....	Base	.....	.....
65	Finder	1904	F	3	1 year	Base	.....	.....
66	Flateau	1904			In discussing Finder's report, "Saw a year ago a patient with just such a growth which made no disturbance."			
67	Riethus, O.	1904	F	17	1 year	Base	Dysphonia, dysphagia	Half-rounded, walnut size, smooth, elastic
68	Smith, O. C.	1904	F	50	7 years	Base	Dysphonia, dysphagia	Ovoid, firm, elastic, painless
69	Allen, Ingersoll and Ludlow	1905	F	18	3 years	Base	Dysphonia, dysphagia dyspnea	Hemispherical, smooth
70	Ewald	1905			Quoted by Meixner, personal communication by Ewald: "He dissected a child in 1890 with a goitre of the base of the tongue. Prof. Kolisko substantiated the diagnosis. The preparation seems to have been lost."			
71	Lenzi	1905	F	42	Began in attack of typhoid fever	Right submental and base	Dysphagia, dyspnea, dysphonia	Pigeon's egg, spherical, elastic, firm, smooth, vascular

(CHRONOLOGICAL).

Treatment	Histological Examination	Outcome	Endocrinal Influences	Thyroid in Normal Position
Removed by heavy wire snare	Not given	Postoperative myxedema	.....	Present
Enucleated by median pharyngotomy	Thyroid tissue with mild colloid cystic degeneration	Recovery	.....	.....
Removed by excision thru mouth	Thyroid tissue	Recovery	Had not yet menstruated	Present
Removed by median suprahyoid route	Thyroid tissue	.....	Menses normal since 14	.....
Not removed	None made	.....	Appeared at onset of menses	Middle lobe not palpable and lateral lobes questionable
Portion only removed	Amyloid	Left hospital still with tumor but without complaint	.....	Scarcely palpable
Removal	Thyroid tissue	Relieved, recurrence 3 months later	.....	.....
Previous attempt at removal had been unsuccessful. At time of report, she had not yet been operated upon.				
.....	.....	.....	.....	.....
Section removed with galvanic snare	Thyroid tissue	.....	.....	.....
Half removed	.....	.....	.....	.....
.....	.....	.....	.....	.....
Subhyoid pharyngotomy. Tracheotomy	Colloid struma	Recovery	.....	Not palpable
Removed with ecraseur	Thyroid tissue	Had recurred 2 years after first removal, again after second, necessitating third operation.	.....	Present
Removed thru mouth tracheotomy	Thyroid tissue	.....	.....	.....
.....	.....	.....	.....	.....
Removed both thru lateral pharyngotomy	Thyroid tissue	Postoperative myxedema	Menses at 15. Irregular	Absent

SUMMARY OF CASE REPORTS

	Author	Year of Report	Sex	Age	Duration	Location on Tongue	Symptoms	Appearance
72	Meixner, K.	1905	F	20	1 year	Base	Pain in neck, pressure in mouth	Size of nut, smooth, vascular
73	Meixner, K.	1905	F	New-born	.....	Base	.....	Size of hazelnut, brown-red, vascular, sufficiently large to cover the larynx
74	Murphy, J. B.	1905	F	34	15 years before had had incision with exhausting hemorrhage	Base	9 years before had appeared in submental region. Mechanical irritation	Size of hen's egg
75	Murphy, J. B.	1905	M	45	3 weeks	Base	No discomfort	.....
76	Paton, E. P.	1905	F	15	For months	Right side floor of mouth	Feeling of swelling in mouth	Size of walnut
77	Quensel, U.	1905	F	30	10 years	Base	.....	.....
78	Schwarz, D.	1905	M	28	1 year	Base	Dysphagia	Size of hen's egg, smooth, elastic
79	Berger, P.	1906	F	32	5-6 years	Base	Dysphagia, dyspnea	Size of an egg, hemispherical, smooth, pale
80	Dieterle, P.	1906	....	4 mo.	Since birth	Base	Died of congenital myxedema	Found only in sections of tongue at autopsy
81	Goris	1906	F	50	1 month, following trauma	Tip	Mechanical	Size of small nut. Spherical, tip of tongue
82	Jacques	1905	F	16	Some years	Base	Dysphonia, dyspnea	Size of small mandarin
83	Jacques	1906	F	22	.....	Base	.....	Size of small mandarin
84	Makins, G. H.	1906	F	31	.....	Base	Dysphagia	Size of walnut, smooth, vascular, firm, elastic
85	Strauss, M.	1906	F	25	5 months following a "cold"	Base	Dysphagia, dryness in throat	Size of small walnut, reddened mucosa, firm
86	Wikerhauser, T.	1906	F	32	2 months	Base	Dysphagia, dyspnea	Nut-sized, hemispherical, hard, vascular
87	Dundas-Grant	1907	F	23	5 years	Base	Dysphagia, dysphonia	Rounded, smooth, vascular, elastic

(CHRONOLOGICAL).

Treatment	Histological Examination	Outcome	Endocrinal Influences	Thyroid in Normal Position
Removed thru mouth	Colloid goitre	Amenorrhea (postoperative) with myxedema	Menses after 14. Regular	Only right lobe palpable
This was a case of attempted destruction of a premature fetus by the mother by drowning. Autopsy proved the attempt unnecessary and unsuccessful. The child actually died by strangulation by the lingual thyroid. Histological examination showed thyroid tissue.				Absent
Removed by median vertical suprahyoid pharyngotomy	.....	Recovery	Menses at normal age	.....
Removed	Thyroid tissue	.....	.....	.....
External approach, removal	Thyroid tissue	.....	.....	.....
Removed thru mouth	Thyroid tissue	Recovery. No recurrence after 2 years	.....	.....
Removed thru median transverse pharyngotomy. No treacheotomy	Thyroid tissue	.....	.....	.....
Median transhyoid pharyngotomy	Thyroid tissue	Postoperative myxedema	.....	Absent
.....	Small epithelial tumor resembling thyroid	.....	Congenital myxedema	No trace
Removal	Thyroid tissue	Recovery	.....	.....
Removed by galvanic snare	Thyroid tissue (embryonal)	Recovery	.....	Absent
Removed by galvanic snare	Thyroid tissue (embryonal)	Recovery	Retarded in development	Absent
Partial removal thru mouth	.....	Recovery	Changes in size not related to menstruation	Lateral lobes present, isthmus not palpable
External pharyngotomy	Thyroid tissue	Recovery. no change in Basedow symptoms	Preoperative appearance of Basedowism	Not palpable
Avoided operation because of lack of normal thyroid	.....	.....	.....	Not palpable
None given	.....	.....	.....	.....

(To be continued in December issue.)

THE AMERICAN BOARD OF OTOLARYNGOLOGY.

An examination was held in New York City, Sept. 25 and 26, prior to the meeting of the American Academy of Ophthalmology and Otolaryngology. One hundred and twenty candidates were examined — of this number 103 were certified.

An examination will be held in Philadelphia, June 7 and 8, 1937, during the meeting of the American Medical Association, held in Atlantic City.

Prospective applicants for certificate should secure application blanks from the Secretary, Dr. W. P. Wherry, 1500 Medical Arts building, Omaha, Neb.